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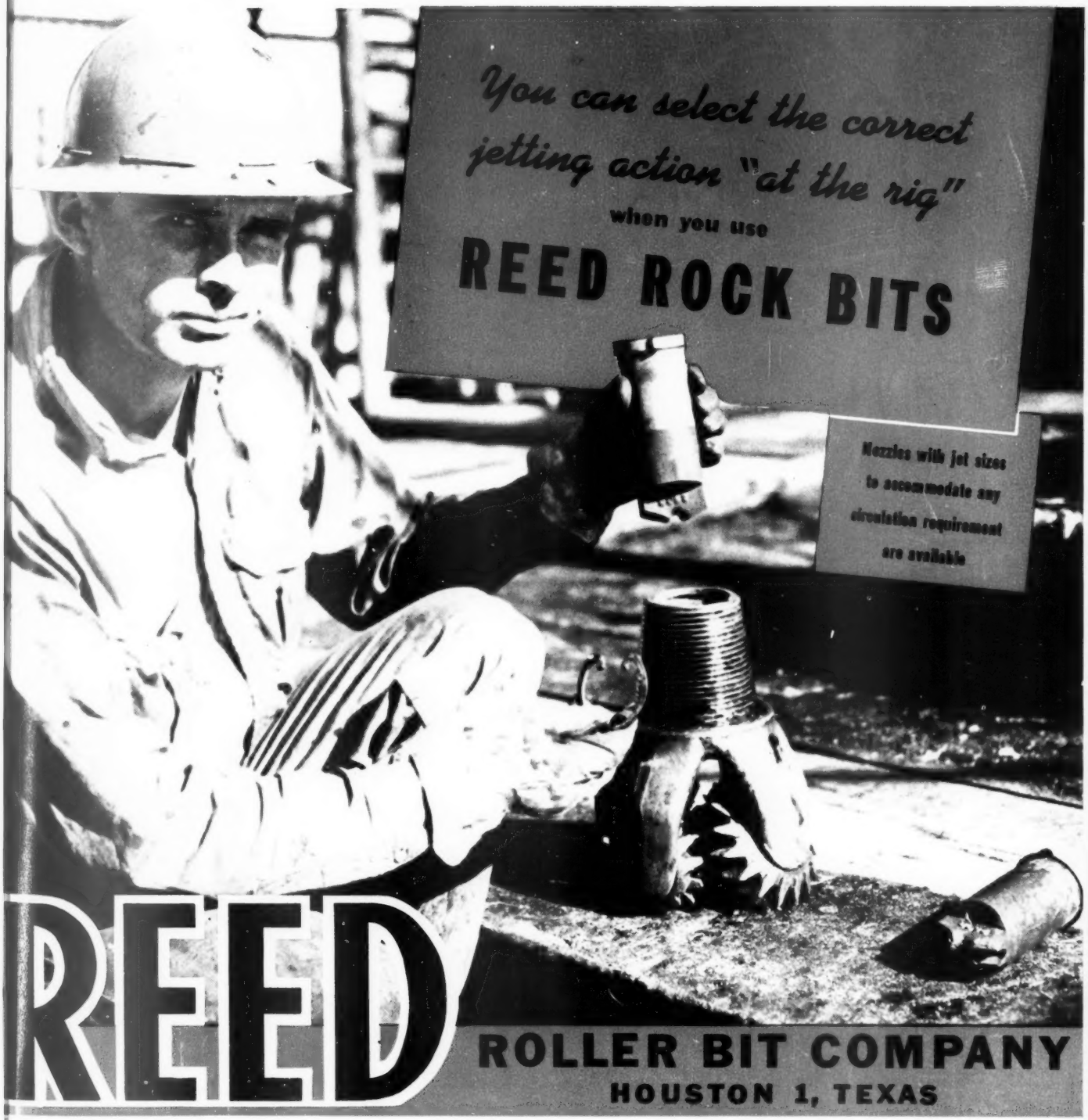
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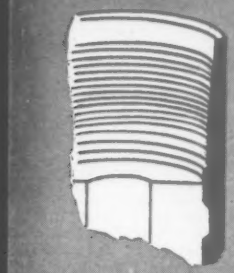

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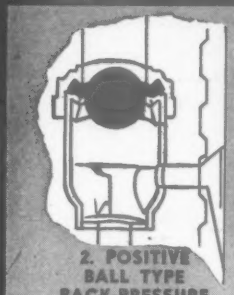

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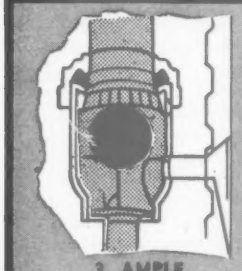

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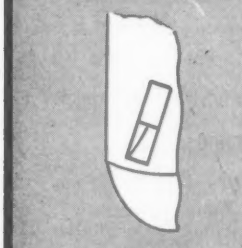

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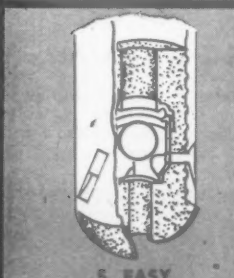

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THE OIL AND GAS JOURNAL

Natural-Gas Issues

WHAT'S all this hullabaloo about natural gas and the Federal Power Commission?" a Mid-Continent producer asks. He is confused by testimony that has been presented at FPC hearings. He is chiefly concerned as to whether the market for residue gas from natural-gasoline plants, which represents a substantial part of his net income, will be affected.

This producer and many others do not fully realize that everything that touches the future of the natural-gas industry is involved in the policies to be established following the hearings. FPC is conducting an investigation which probably will determine whether production and distribution of natural gas are to continue as a private enterprise or whether public-utility controls are to center in Washington.

The Natural Gas Act of 1938 did give the commission specific authority over interstate transportation and sale of natural gas. Judged by its decisions and pronouncements over the past 3 years, the commission now seeks to go far afield from the intent of the congressional framers of the law.

The commission has gone into the end uses of natural gas. It has given support to contentions, first offered by competitors of natural gas, that consumption of this convenient and economical fuel should be restricted to the preferential uses. The expansion of the industrial use of natural gas—the principal outlet—is at stake.

If these regulations at the consuming end of the pipe-line systems are permitted, obviously it will not be difficult to justify full control at the producing end. This is in line with the tendency of federal commissions and bureaus to insist that they can't adequately regulate interstate commerce without controlling the sources of supply, including returns on investments.

In the case of natural gas the probable applications are readily apparent. State controls of field operations would end. Because a substantial part of the marketed natural gas is produced with crude oil, government controls would inevitably extend to the vital operations of the petroleum industry.

So there is cause for the efforts being made by producers to present their case, to which the Mid-Continent operator referred. The natural-gas industry, solely through the efforts of producers, transporters, and distributors, has greatly strengthened its position as a supplier of a basic commodity of our entire economy. Possibilities for growth in the future are as great as they ever were. A federal commission, via the backdoor method, now seeks to restrict further expansion.

The hearings already completed and those scheduled will clearly define the issues. Concerted action on the part of both the natural-gas and petroleum industries will then be needed to end federal control encroachment, still in its initial stages.

Left: Maston Nixon, vice president, Southern Minerals Corp., and N. C. McGowen, president, United Gas Pipe Line Corp., exchange views at the Houston FPC hearing. Right: Olin Culberson, chairman, Texas Railroad Commission; D. A. Hulcy, president, Lone Star Gas Co.; Marshall Newcomb, counsel, Lone Star Gas Co., and Paul A. McDermott, attorney at Fort Worth for Sinclair Prairie Oil Co., discuss the progress of the hearing

Proper Price Incentive Would Do Much To Further Gas Conservation

by Charles J. Deegan

HOUSTON.—An increase of 1 cent, or a 40 per cent raise over the average Texas well-head price of gas in 1944, would mean less than 3 per cent higher cost to the ultimate consumers if passed directly on to them, according to Dr. Richard J. Gonzalez, economist for Humble Oil & Refining Co., in testimony before Federal Power Commission, during the second week of its hearings here.

The technical men, and the realistic economics of Dr. Gonzalez, dominated the barrage of testimony laid down in the record, as the commissioners resumed their formal hearings, after being taken on a field tour of the Katy field during the week end, to get a first-hand view of modern large-scale cycling operations.

Backing up statements made by other witnesses in the previous week's testimony, Dr. Gonzalez told the commissioners that gas conservation is a matter of economics as well as engineering, and that adequate gas prices are required to provide an incentive for producers to save and market gas produced with oil. Present prices in Texas, Louisiana, and Oklahoma, with two-thirds of the known gas reserves of the nation, are too low.

Pointing out that at present well-head prices, the gas revenue from an average oil well in Texas is only about 60 cents a day, he said, "This is inadequate to cover the expense of gathering and compressing gas in many small fields and certainly does not offer much incentive to making the necessary initial investment for gas conservation. As gas prices improve, it will become economically feasible to conserve and utilize fully an increasing proportion of the gas produced with the oil."

In developing his contention that a 40 per cent increase in the price of gas at the well head would mean only a 3 per cent increase to the ultimate consumer, the economist pointed out that the average price paid by consumers for gas is about 31 cents per thousand for domestic, commercial, and industrial uses, and 22 cents for all uses. "The average price paid for gas at the well is only about 18 per cent of the delivered cost to domestic, commercial, and industrial consumers. An increase of 1 cent per thousand at the well, which would be 40 per cent of the 1944 price in Texas, would mean less than 3 per cent higher cost if passed directly on to these users."

He thought that the consumer of natural gas is interested not only in the present price but in a continuous supply over a long period of years, and that this should be considered, since a policy of looking only to what immediate price reductions could be made might well sacrifice the consumer's long-term interest.

The total revenue from gas sold in Texas in 1944, according to the economist, was less than 5 per cent of the value of the oil produced, or $37,627,000. Concerning the justification for an increased price, he said, "In terms of heating value, 6,000 cu. ft. of gas are approximately equal to a barrel of oil, but 50,000 cu. ft. sell for about the same price as a barrel of oil in Texas."

Gov. John J. Dempsey of New Mexico notified the commission, by a letter and formal statement for the record, that New Mexico holds views on the rights of the individual states to control and conserve their own natural resources, which it soon developed were just as strong, and practically identical with the views previously expounded by Gov. Coke Stevenson of Texas.

However, in elaborating on these principles of states' rights, the governor called attention to the fact that the state is one of the large landowners in New Mexico, and collects large oil and gas-lease bonuses, rentals, and royalties. As a landowner the state objected vigorously to any federal regulation (obviously referring to the Canadian River gas case) which devalues its lands for oil and gas leasing, or limits, or restricts

the value of its reserves, or restricts its income. The state of New Mexico insists as a landowner, that it is entitled to the earnings on its lands arising from the discovery value of oil and gas, and that any other policy deprives the state of its property.

Any regulation, according to the governor, which deprives New Mexico of these discovery values, and transfers such increased values to gas consumers in nonproducing states is detrimental to its interests, is not authorized by Congress, and is confiscation of property belonging to the State of New Mexico.

Beneficial use is made of practically all of the gas produced from gas wells in Texas, as a result of informed regulation by the Texas Railroad Commission and conscientious effort by the operators, and these same two factors have already made substantial progress toward maximum possible utilization of casinghead or residue gas, according to L. T. Potter, superintendent of production and assistant general superintendent of Lone Star Gas Co.

Explaining that utilization of gas production in gas pipe lines requires fulfillment of certain basic conditions to maintain satisfactory line operation, Potter said that the production available to the pipe line must provide gas reserves of sufficient magnitude to assure a continuous and adequate supply during a reasonable period in the future, and must have a current capacity to deliver gas to the line in amounts and at times required by consumer demands at the other end of the pipe line.

Using typical cases, he showed how hourly variations during the day fluctuated, so that the maximum hour demand was twice the minimum hour; and that fluctuations in total demand for a day were so wide that on the maximum day, the demand was more than three times as great as on the minimum day. Nevertheless, delivery capacity sufficient to handle a peak hour's demand must be available at all times, whether in use or not.

Notwithstanding the difficulties in utilizing casinghead residue gas, the problems must be solved as far as economically feasible, and substantial progress has been made, according to Potter; one company having utilized 186 billion cubic feet of residue gas compared to 323 billion cubic feet of dry gas in a 10-year period.

Going to the crux of the problem from an engineering standpoint, Stuart E. Buckley, head of production research for Humble Oil & Refining Co., told the commission that "the real issue is whether gas conservation in Texas is static, is decreasing, or is being capably and efficiently handled, and is improving at a satisfactory rate." His own opinion on that issue was "that the record shows beyond question that the present cooperation between the state administrative authorities and the petroleum industry is proceeding vigorously and expeditiously to conserve a continuously increasing portion of the casinghead gas produced from crude oil."

Explaining the engineering principles of reservoir energy mechanics, Buckley told the commission that the primary use for casinghead gas is in effecting oil recovery and that production of the gas was not waste, but an essential part of oil production. Therefore its conservation must be considered separately from its final disposition, since it was fully conserved if used in the minimum quantity and most efficient manner possible in production of oil. Its use after serving that purpose is a byproduct use and an element of conservation or waste only against a background of demand and economics. Any attempt to regulate production of casinghead gas separately from the production of crude oil would cause confusion and would result either in disruption of crude production or underground waste of oil.

Gas Conservation Not Static

Conservation of gas is not static, and Buckley indicated three directions in which the need for improvement is evident; first, the amount of gas produced with oil should be still further restricted to approach minimum requirements for efficient oil production; second, more gas should be returned to oil reservoirs for pressure maintenance, where economically feasible; and third, there is need for further consumption of the produced gas. However, he pointed out that many conservation projects had been held up during the war by shortage of materials, and that projects now under construction or planned for the immediate future would further reduce the amount of gas vented.

Operation of natural-gasoline plants has been a corollary to oil production and has served as a preeminent conservation measure, and any policy designed to give a utility status to the operation of such plants should be opposed, according to M. L. Mayfield, former technical adviser-engineer for Petroleum Administration for War District 3, natural gas and gasoline committee.

He told the commissioners that "in connection with pipe-line usage of casinghead residue, it is becoming increasingly apparent that certain inferences and apprehension toward administration of the broad provisions of the present Natural Gas Act are acting as partial deterrents to the role of private enterprise, and there should be no tendency to augment or extend jurisdiction, directly or indirectly, over such auxiliary operations as natural-gasoline-plant processing, or gas gathering of casinghead gas, even though such casinghead gas may eventually be sold to interstate pipe lines or markets."

Natural - gasoline - plant and pressure-maintenance operations inherently contribute to each other, and it is hoped that within the near future new and large-scale projects of this type will be started. Any policy designed to give a utility status to this operation will act as a deterrent to this desired objective.

Texas cycling-plant operators are fearful that the opening of one valve may put them in the utility business, Robert T. Wilson, president of La Gloria Corp., Corpus Christi, testified. He explained that frequently operation was all that was required to effect sale of residue gas to a gas-pipeline company. Ground rules suitable for the transmission and retail distribution of gas did not properly apply to cycling-plant operators, who were in the hazardous business of exploration and production of gas and the

Tom J. McGrath, attorney for coal and railroad interests, argues at hearing

Leland Richardson, counsel for State of Louisiana on gas matters, reads from testimony

manufacture of liquid products therefrom.

Their cycling operations were a handmaiden to oil production, he explained, handling casinghead gas at low pressures in a portion of the plant, and coincidentally processing the gas from the gas cap. The process becomes tied inseparably to oil production and control of oil production becomes control of gas production, and vice versa, control of gas production becomes control of oil production. Both are now in the hands of the Texas Railroad Commission and the industry fears and opposes any effort to make it otherwise.

Explaining that the cycling process did not solve the problem of finding a market for the gas from gas-distillate fields, but merely postponed it, he gave data on the scope of such operations in Texas. There are more than 30 projects operating, with a capital investment in wells, plants, and plant facilities of nearly $100,000,000, and additional plants are in the design stage. The operating plants process almost 2½ billion cubic feet of gas every 24 hours, with the largest plant accounting for a little over 20 per cent of the total.

Pointing out that Texas exported, on a net basis, only about 1 billion cubic feet per day during 1944, Wilson said that Texas cycling-plant operators could note with satisfaction that their industry alone stores about 2½ times that amount every day for future use, while producing a total of more than 50,000 bbl. per day of liquefied hydrocarbons. This latter production represents about 60 per cent of the total for the industry.

In an attempt to clear up many common misunderstandings about carbon black, and the question of waste or efficiency involved in the use of natural gas for its manufacture, E. M. Eckhart, vice president, and Ira Williams, director of research, for J. M. Huber Corp., brought out some interesting comparisons for the benefit of the commissioners.

The two primary uses of carbon black are as a rubber-reinforcing agent in automotive tires, and in the manufacture of printing inks for high-speed presses.

There is no adequate substitute for carbon black as a rubber-reinforcing agent, particularly in the case of synthetic rubber. Zinc oxide, once used as the preferred rubber toughener, requires more than 3 times the number of pounds, at a pound cost about double, and produces a tire that will wear about half as long, which figures out a use efficiency of about one-twelfth that of carbon black.

Whereas natural-rubber tires needed carbon black only in the treads, synthetic-rubber tires require carbon black in the carcasses as well, and furthermore synthetic rubber can be satisfactorily vulcanized only in the presence of carbon black. Fifteen pounds of carbon black will give synthetic-rubber passenger-car tires a 20,000-mile life. It takes 7,500 cu. ft. of gas worth 30 cents to produce the 15 lb. of carbon black, worth 75 cents. But it will require 1,000 gal. of gasoline, worth $200, to run the car until the 30 cents worth of gas and 75 cents worth of carbon black in the tires have been used up.

The witnesses also stated that the percentage of efficiency in recovering the available carbon in both channel and furnace processes is greater than for any other operation which uses gas for fuel. The over-all efficiency obtained in the production of carbon black by channel and furnace processes is 31 per cent and 56 per cent respectively.

By contrast, gas fired into an industrial boiler operating at 80 per cent efficiency, delivers steam into a triple expansion steam engine with a 20 per cent efficiency, giving a net fuel-utilization efficiency of only 16 per cent. Gas turbines operate at about 29 per cent efficiency; automobile engines at about 20 per cent and steam locomotives around 6 per cent.

How German techniques for making gasoline and diesel oil from coal have been adapted by American refining experts to obtaining these same products from dry gas, was explained by R. C. Alden, director of research for Phillips Petroleum Co. He reported that large-scale operations are now being planned by the petroleum industry to utilize these adaptations, and that inasmuch as the known dry-gas reserves could thus be processed to yield as much gasoline as can be made from the known oil reserves, the net effect is to double the nation's potential gasoline supply.

Much progress has already been made, according to Alden, in the adaptation of foreign processes to American conditions, and of all processes, the Fischer-Tropsch is by far the most advanced and most promising. Large sums of public money have been appropriated for government research along these lines, and private industry, including both coal and petroleum interests, have been carrying on extensive research.

He stated that "on the basis of conservative published estimates, the synthesis process utilizing natural gas will not be able to compete with present refinery methods utilizing crude petroleum until the price of crude reaches about $1.75 to $2.00 per barrel," but "on the basis of more optimistic published estimates, the process is competitive now at about 10 per cent depreciation on capital investments."

Here are 12 of the 21 members elected to the board of directors of the Independent Natural Gas Association of America to serve during 1946. Election was held at the group's annual meeting in Houston January 28. Bottom row: C. H. Alexander, Corsicana; D. D. Harrington, Amarillo; H. W. Long, Guymon, Okla.; J. H. Dunn, Amarillo; Harry L. Mann, Memphis. Top row: Mark Adams, Wichita; Burt R. Bay, Omaha; William H. Wildes, Dallas; F. S. Kelly, Jr., Shreveport; E. C. Jouillian, Oklahoma City; D. A. Hulcy, Dallas; E. Buddrus, Chicago

THIS WEEK

SUBSIDY—Stripper-well subsidy payments continued through June 30, unless ceilings are abolished earlier. . . . ¶Secretary Ickes advocates stripper subsidy as permanent policy—for conservation of marginal wells. . . . ¶Reconversion Director Snyder and OPA Administrator Bowles in dispute over oil-price increases. . . .

OIL TREATY—Harry F. Sinclair issues blast against Anglo-American oil pact. . . . Militant Texas group continues publicity campaign opposing Senate ratification. . . . I.P.A.A. explains its support of agreement represents views of membership majority, arrived at after full discussion and circulation of document. . . . Treaty supporters allege Sinclair criticism discloses lack of information. . . .

LABOR—Formula of 18 per cent increase in oil-industry wages gaining momentum. . . . Most companies have made adjustments or are in process of negotiating 18 per cent increment. . . .

WASHINGTON—Opposition to Edwin W. Pauley's nomination for under secretary of Navy developing into unsavory fight. . . . Industry suffers from inference of backroom politics. . . . Charges against Pauley are unsupported and are result of private political feuds, breached friendships. . . . ¶Tidelands hearings before Senate judiciary committee under way this week. . . . Coastline states united in program of seeking congressional approval of title to submerged land. . . . Department of Interior wants Supreme Court ruling on title dispute, feeling it would favor federal ownership. . . .

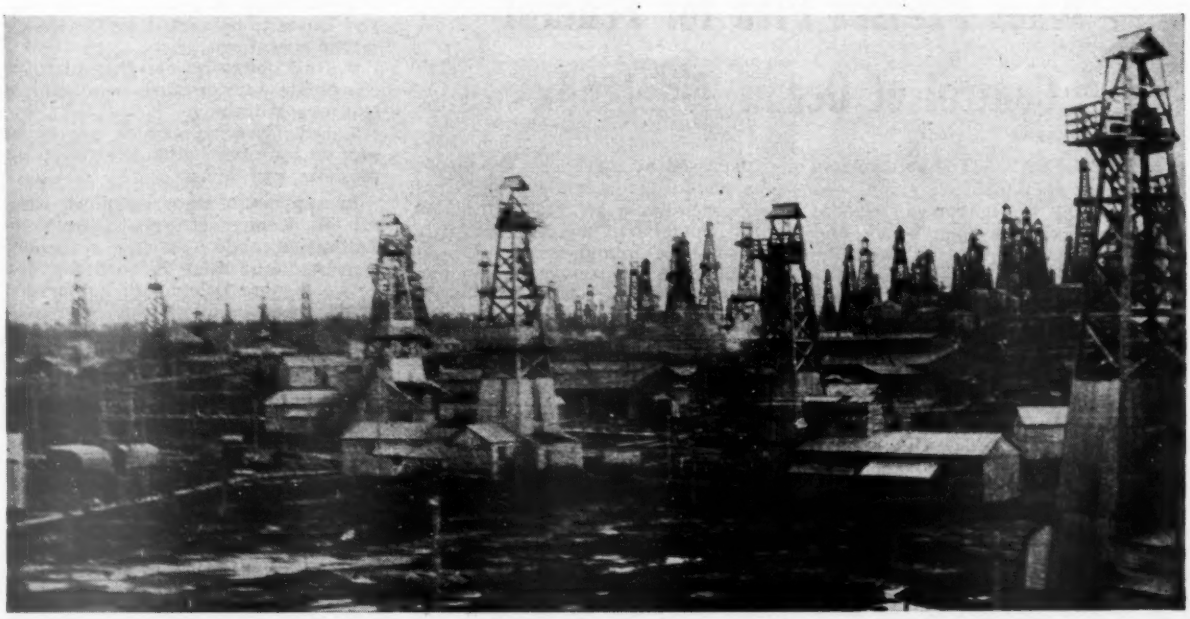
DEMAND—Bureau of Mines forecasts February demand for crude oil at 4,430,000 bbl. daily. . . . Decline may occur in March when gasoline inventory is expected to reach storage capacity. . . . ¶Exports and imports approximately in balance at 360,000 bbl. daily. . . .

DRILLING—Completion rate down slightly from mid-January level. . . . First month's activity about 250 wells above comparable 1945 record. . . . Pennsylvania, Texas and Louisiana outstanding in increases so far. . . .

MARKETS—Refinery-gasoline prices continue weak. . . . ¶Barge strike in New York area chokes flow of products. . . . ¶Residual and domestic fuel oils remain scarce at firm prices. . . . ¶Off-specification motor fuel particularly weak and offered freely in most refinery districts. . . .

NATURAL GAS—FPC hearings at Houston drawing to close. . . . Importance of price as conservation incentive stressed in building FPC record. . . . Witnesses testify increase of 1 cent per 1,000 cu. ft. in field price would mean only 3 per cent advance to consumers. . . . Such economic incentive would eliminate most of waste in Texas. . . .

This view of the Sakhalin Island petroleum operations under direction of Soviet Russia indicates that dense drilling is the rule, possibly accounting for the charges and countercharges concerning certain European oil properties. The U.S.S.R. has alleged inefficient production practices in parts of occupied Europe where American and British petroleum interests are seeking to recover prewar properties



Sovfoto

Rives New Advertising Manager of Journal, Petroleo Interamericano

WAYNE RIVES of Houston has been appointed manager of the advertising departments of The Oil and Gas Journal and Petroleo Interamericano, succeeding Ernst Klappenbach who died January 26. Rives has been in charge of the Gulf Coast advertising office for more than 10 years. He will arrive in Tulsa February 11 to assume managership of the general department in the home office.

Rives became a member of the Journal's advertising staff in 1935 and served as Gulf Coast representative until 1942 when he was appointed manager of that territory. Previously, he had engaged in commercial photography with special emphasis on production of advertising copy for petroleum-equipment manufacturers. He is a licensed pilot, owning and operating a private plane. He was born at Rhome, Tex., in 1908 and moved to Houston in 1921 where he has since resided.

WAYNE RIVES

J. V. (Doc) Pennington, Houston, formerly engaged in sales, research and engineering work for several oil-equipment manufacturers, has been appointed Gulf Coast manager, succeeding Rives. Pennington was sales manager and consulting engineer for McEvoy Co. and previously was vice president of Reed Roller Bit Co., Houston, serving successively as research director, California branch manager, and works manager. He taught engineering from 1927 to 1933 at Rice Institute. He has a degree in mechanical engineering from Stevens Institute of Technology and received his Ph.D. degree from Rice.

Ickes Presses Plea for Federal Control of Ocean Tidelands

WASHINGTON. — The controversy over ownership of submerged lands should be narrowed to title to the bed of the open ocean and this question left for the Supreme Court to decide, Secretary of the Interior Harold L. Ickes told Senate judiciary committee February 5 as hearings opened on a resolution to drop all federal claims to such lands.

Ickes offered an amendment to House Joint Resolution 225 which would disclaim federal ownership of all tidelands, reclaimed or filled lands, and all lands beneath harbors, bays, or inland lakes or rivers, leaving open only the question of title to coastal lands beyond the low-tide mark. He said that the Supreme Court has never passed on title to coastal lands although it has repeatedly asserted state title to the tidelands and river beds his amendment would exempt.

As passed by the House the resolution would assert state title to all submerged lands without distinction. Ickes' amendment would remove the opposition of inland states, port authorities and others who have joined with the State of California in defending a suit pending in the Supreme Court by which the federal Government seeks title to coastal oil lands off California. Senate approval of the resolution in the form passed by the House would nullify this suit.

Ickes admitted his only interest in asserting federal title to coastal lands is to get control of their oil deposits, denying any intention of upsetting state title to other submerged or filled lands which he said was well established by the courts. He insisted no court has ever passed on state claims to the ocean bed and said this is a question of law to be decided by the courts rather than Congress. Admitting he once ruled that the federal Government has no claim to coastal oil lands, Icker said he now has doubts and wants the question decided by the courts. He took no issue with legal arguments supporting state claims, saying only that since the attorney general has asserted federal claims, Congress and the executive departments should leave the matter to the Supreme Court.

There are reasons of greatest importance why the federal Government rather than California should control the oil which lies in the ocean bed off the coast, since California has always produced oil and natural gas wastefully and recklessly, Ickes said. The submerged coastal lands are the greatest potential reserve of oil which we have and they should be set aside as petroleum reserves and explored by the federal Government, Ickes said, as the highest use of that oil is to hold it as a reserve for future needs.

If federal title to coastal oil is established, Ickes proposed legislation to provide:

1. Persons operating under state law be relieved of damage for past trespass, and outstanding leases and contracts be continued by the federal Government at least as to royalty rate and time limit.

2. Structures erected on submerged lands and surface title to filled lands not be disturbed.

3. The lands be held as a federal oil reserve and their administration coordinated with other federal oil reserves.

4. The interior department to explore submerged lands and plan for their development for emergency needs.

5. Authority for exchange of lands and leases to prevent drainage by adjacent operations.

6. Unit operation or other plans to coordinate with on-shore development to prevent drainage.

7. Development in such a way as not to interfere with navigation or seashore recreation.

In support of the resolution Robert W. Kenny, attorney general of California, made a lengthy statement asserting that there is no distinction between state title to all submerged lands whether along the open seacoast or under rivers and harbors, that states have always exercised jurisdiction over all submerged lands without question from the federal Government until recently, and that federal assertion of title to coastal lands would automatically cloud title to all submerged and reclaimed lands.

Kenny's position was supported by a score of other witnesses representing other states, cities, and port authorities, most of them concerned over title to river beds, harbor works, fisheries, and filled lands now parts of cities.

Friction Over Petroleum Matters Developed at Pauley Hearing

by Henry D. Ralph

WASHINGTON. — Senate hearings on the confirmation of Edwin W. Pauley as Undersecretary of the Navy last week developed into an airing of intra-administration friction over various petroleum matters, particularly title to submerged oil lands and construction of a 100-octane refinery in Mexico.

Pauley had taken an active part in these in his capacity of stockholder and official of Petrol Corp. of California and treasurer of the Democratic National Committee, and in his appearance before the Senate naval affairs committee he defended his actions as being straight business deals devoid of political pressure. Other witnesses, however, made it appear that Pauley used his political influence to enhance the position of his company contrary to what the witnesses said was the public interest.

Chief of these witnesses was Secretary of the Interior Harold L. Ickes, who refused to criticize President Truman's selection for a sub-cabinet post, but who made it clear that he didn't like Pauley or his past history. Others were Max W. Thornburg, formerly an official of Standard Oil Co. of California and affiliated companies and at one time special petroleum adviser to the Secretary of State; and Norman Littell, former Assistant Attorney General.

The tidelands matter provoked the most interest since the subject is currently in the public eye because of the pending Supreme Court suit against the State of California by which the federal Government seeks title to submerged oil lands beyond the low-tide mark and because of Senate hearings scheduled for this week on a House-approved resolution to reliquish all federal claims to such lands.

Pauley, whose company has a small production from California tidelands involved in the litigation, freely admitted that he sided with the state against federal-ownership claims but denied that he had sought to have the federal claims dropped in return for contributions to the Democratic campaign fund.

Ickes, under questioning, flatly contradicted this, saying Pauley had told him it would be bad politics to file the suit and that several hundred thousand dollars could be raised for the party if federal tidelands claims were dropped.

Littell also told the committee that Pauley, during the repeated efforts to prevent filing the suit, had mentioned the contributions angle in an effort to influence government officials, particularly at one conference where Pauley introduced Littell to Harry Marsh, president of Signal Oil Co. Littell's testimony suggested that Pauley was responsible for the failure of the Department of Justice to file the tidelands suit until after President Truman took office although the late President Roosevelt and other government officials had been interested in the matter for several years.

Mexican Deal Injected

Pauley was also accused of lobbying for the pending legislation to relinquish federal claims to all submerged lands, through introducing W. W. Clary, assistant attorney general of California, and others, to Speaker Sam Rayburn of Texas and various senators. Pauley replied that he had made such introductions but without using any political pressure, and later Speaker Rayburn testified that he was always opposed to the federal claim to tidelands and had not been influenced by Pauley.

The Mexican oil deal involved a contract made in 1942 by Pauley and associates, including Sam Mosher of Signal Oil Co. and Jack Blalock, Texas oil operator and attorney, to construct a 100-octane-gasoline refinery and installations to utilize gas from the Poza Rica field in Mexico. Thornburg testified that the State Department withheld approval of this contract because it felt that the Mexican Government was not getting a fair deal and that contracts of this sort would react against the position of American oil firms in foreign countries. He said that for months the White House and the Interior Department brought pressure for approval of the deal until he wrote a strong memorandum, approved by Secretary of State Cordell Hull, outlining the facts pertinent to this contract.

Harris & Ewing

Edwin W. Pauley, whose nomination for subcabinet post prompts Senate hearing

At one time during this period, Thornburg testified, Pauley had lunch with him and threatened to have him "liquidated" if he failed to give prompt approval to the contract. Early in 1943 President Roosevelt met President Camacho of Mexico at Monterrey and reached an agreement under which the Mexican Government built the 100-octane plant with funds advanced by the U. S. Government, so the Pauley contract never went into effect. Thornburg implied that Ickes and Deputy Petroleum Administrator Ralph K. Davies exerted undue influence on behalf of the Pauley contract, and that Pauley probably was responsible for the State Department's request for Thornburg's resignation late in 1943. This was vigorously denied by Ickes, who claimed for himself the credit for getting Thornburg fired, chiefly because of a trip Thornburg made to Venezuela which Ickes said was for the benefit of certain individual oil companies rather than for the U. S. Government. Ickes also denied that he had supported Pauley's contract after he got a factual report on the situation.

Another subject touched upon during the hearings. and which may be discussed more fully at subsequent sessions, was the custody of government oil reserves. Ickes has publicly advocated transfer to the Interior Department of the Naval petroleum reserves. Some of the senators questioned whether Pauley, as an oil man, should be in charge of Naval oil reserves. Pauley himself suggested that government oil holdings be supervised by a commission consisting of the Secretaries of Interior, War, and the Navy.

While much of the testimony before the committee dealt with long histories of personal jealousies and interagency squabbles within the administration rather than with Pauley's qualifications to be Undersecretary of the Navy, the hearings have caught such wide public attention that Pauley's confirmation appears to be seriously in doubt.

INTERNATIONAL

Creole Considers New Locations for Refinery

CARACAS. — Proposals by which the Creole Petroleum Corp. would establish a refinery on a tract of government land in the Turiamo Bay region have run into further difficulties with the result that the company is considering locations in two other Venezuelan states.

Dr. Perez Alfonzo, Minister of Development in the revolutionary government, expressed the view that only a jointly owned refinery "in which the national government and private enterprise would share" would be acceptable "in the choice site of Turiamo."

Arthur T. Proudfit, Creole vice president, has told Dr. Alfonzo that the refinery could possibly be established at Los Tanques Bay or at Puerto La Cruz in order to fulfill commitments made to the government. Dr. Alfonzo later said the proposed refineries must be in operation by January 1, 1951, under contracts now in force, and that three possible locations are being studied—Punta Cardon, Puerto La Cruz, and Paraguana.

At Puerto La Cruz in the State of Anzoategui, Creole now owns sufficient land for locating the plants, camps, docks and auxiliary equipment. At Los Tanques Bay in the State of Falcon, the company also owns about 200 acres of land.

Plans to sell between 2,000 and 2,450 acres of government-owned land in the Turiamo Bay region touched off a heated controversy. The overthrown Medina regime favored the Turiamo Bay location, considering that company improvements with construction of the refinery would raise the general living standards in the area. Negotiations were complete except for Medina's signature at the time the new government took over.

South American Conditions To Be Studied by Fagadau

WICHITA FALLS, Tex. — S. H. Fagadau, consulting engineer, was due to leave Miami this week for South America where he will study possible oil development in Peru and Bolivia.

Fagadau will negotiate with agencies of the governments for oil concessions on behalf of Panhandle Producing & Refining Co. He will meet Dr. Victor Oppenheim, South American geologist, in Bogota, Colombia, and V. E. Eckholm, geologist for Bolivia, in Lima, Peru. Later, he will go to La Paz, Bolivia, to study oil legislation, labor conditions, and availability of drilling equipment. He will examine several areas of Peru and Bolivia, particularly the Vera Cruz section and the Chaco region.

Refinery Operation Resumed At Martigues, South France

WASHINGTON.—A resumption of operations for the refinery at Martigues in southern France with crude received from Iraq is reported by the Bureau of Foreign and Domestic Commerce.

The refinery operated continuously during the latter part of 1945. Another French refinery at Gonfreville-l'Archer, near Le Havre, owned by a subsidiary of Compagnie Francaise des Petroles, was reported last October to be ready to resume operations shortly.

Lynton Retained to Guide French Oil Rehabilitation

E. D. Lynton, research geologist for Standard Oil Co. of California and a member of the Pacific Section, A.A.P.G., is en route to Paris, France, where he will be in the employ of the French Government in charge of rehabilitation of the French petroleum industry. He has been granted a 2-year leave of absence by Standard of California. Lynton spent the greater part of 1943 and 1944 in French North Africa for the U.S. Board of Economic Warfare and was requested by the French Government to return and take charge of exploration in southern France.

Socony-Vacuum's Barinas Wildcat Down 2,900 Ft.

NEW YORK.—Socony-Vacuum Oil Co. reports that its Venezuelan subsidiary has resumed drilling of a wildcat test in the Barinas area and is now at 2,900 ft. Drilling stopped at 2,108 ft. to repair block.

Drilling at 5,616 ft. is reported on 32 Guico, a step-out location, in the same area. Drilling at 9,536 ft. on another wildcat test is also reported in the Barinas area.

In Columbia, Socony is reported coring at 8,045 ft. at a wildcat test in the Magdalena Valley district. Floresanta 4 and 5 in the Sinu area were abandoned as dry holes at 1,504 and 1,330 ft., respecively. Work is progressing on 6 Floresanta with Sinu Oil Co. trying to get exportable oil from shallow sands.

Meanwhile another Socony - Vacuum subsidiary, Columbia, S. A., is preparing to run electric log on 1 Pedral, a wildcat which has been drilled to 8,330 ft. in the Magdalena Valley area.

The Venezuelan subsidiary completed 20 Guico at 6,927 ft. as an oil well, and is completing 1 Tascabana, a small gas well, both in the Oficina area.

Houston Men to Fight Fires Left by the Japanese

HOUSTON.—With a record of having subdued more than 175 wild oil well fires, H. L. Patton and his son, Otis Patton, are preparing to return to the Dutch East Indies to fight oil fires left by the Japanese.

They recently came back from Seria, Brunei, a British colony on the west coast of Borneo, where they extinguished 12 fires after Australian engineers had failed. They fashioned fire-fighting material from abandoned Japanese equipment. Otis Patton suffered leg burns.

Heavy Increase Reported In Colombian Investments

WASHINGTON.—Oil development capital found Colombia an attractive investment area during the first 9 months of 1945. A report of the Bureau of Foreign and Domestic Commerce said new capiltal for petroleum companies entered the country in an amount of $26,000,000, approximately double that for the same 9-month period in 1944.

A resulting rise in production in the third quarter to 6,141,000 bbl. from 5,864,000 bbl. for the second quarter was noted. For the first 9 months of 1945, however, total crude output of 16,800,000 bbl. was 200,000 bbl. below the corresponding period of 1944.

Oil Corporation Studied By Peruvian Commission

LIMA. — Creation of a Peruvian corporation to produce and refine state-owned oil and to propose policies for the development of the national petroleum resources is being studied by a special government commission.

The company would operate on a commercial basis and would include the entire present state-owned petroleum property. State petroleum production in 1944 amounted to 85,562 bbl. The Zorritos refinery is now treating 1,000 bbl. daily, and other fields are being explored.

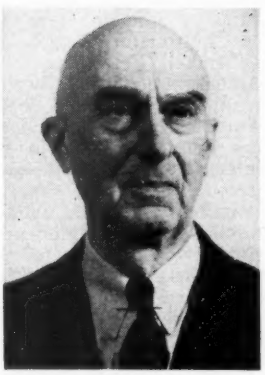
D. H. STORMONT

GEORGE H. WEBER

HERNDON DAVID

JAMES McINTYRE

These members of the Journal and Petroleo Interamericano editorial staffs are involved in recent changes made possible by return of personnel from military service. Three of the men were employed by the Journal before the war and have resumed editorial work. Two veteran employes who returned to active duty during the war have resumed retirement. Two new staff members have been added after discharge from military forces



THOMAS F. SMILEY

DAHL M. DUFF

C. DUDLEY JOHNSTON

Journal Editorial Staff Is Returning to Normal

RETURN of several service men has permitted rearrangement and expansion of The Oil and Gas Journal and Petroleo Interamericano editorial staffs. Two veteran employes who returned to active duty during the war emergency have again retired. Two former service men have been added to the Journal staff. Three writers who went directly from the Journal staff into military service have received discharges and have resumed their journalistic careers.

D. H. Stormont, George H. Weber, and Herndon David are the three veterans who went directly from the Journal into military service and who have now returned to the staff. Stormont has been assigned to the staff of Petroleo Interamericano with which he will write general and technical editorial material and be in charge of certain production affairs. Before entering the Army with which he served as a captain in artillery, with nearly a year in France, Germany and Austria, Stormont served 2 years as Fort Worth district editor and previously had 3 years' experience in the Tulsa office writing and editing engineering and operating articles and handling layout of the engineering section.

Weber who served as a major of artillery and spent approximately 4 years in the Pacific theater, participating finally in the Phillipine liberation, has opened the Journal's newest editorial office at 913 St. Paul St., Dallas. Before entering the Army, Weber worked for a short time in the Tulsa office and later as district editor at San Antonio, Houston and Shreveport. Weber developed some of the first published material on cycling and the articles he wrote in late 1939 are still considered outstanding in the literature on this phase of condensate production.

Herndon David, a lieutenant and bomber pilot in the Army Airforce during the war, completed 35 missions over Germany and has returned to the Journal staff. Before his induction he had worked as an engineering writer and in the Journal's field department. His field work was carried on by James McIntyre during the war. His return to civilian status makes possible McIntyre's retirement.

James McIntyre and Thomas F. Smiley have been members of the Journal's editorial staff for 28 and 19 years, respectively, except for a few months during the latter part of 1940 and early 1941 when both were on retirement. Drain of the war on the Journal's manpower influenced both McIntyre and Smiley to return to active status in order to keep jobs open for younger men who were inducted into military service. Both veteran journalists welcome the opportunity to resume retirement.

Dahl Duff, a graduate in journalism from Oklahoma University, and an Oklahoma City newspaper man before entering the Army as an artillery officer, has assumed Smiley's duties in the news department. Duff was commissioned a lieutenant colonel just before his discharge, having served both in Germany and Japan.

C. Dudley Johnston, the other new member of the Journal and Petroleo Interamericano staffs, served in the Navy during the war. He is a combination artist, photographer, draftsman and illustrator with a background of experience in the engineering department of a refinery and natural-gasoline plant construction company. His talents will be devoted to improving illustrative material.

Sinclair's Views on Ratification Of Oil Treaty Draw Fire

by Warren W. Burns

NEW YORK.—Many oil industry leaders here this week were quick to observe that H. F. Sinclair's statement opposing Senate ratification of the Anglo-American petroleum agreement "evidenced a lack of knowledge regarding the treaty."

A highlight of Sinclair's statement was the assertion that "if the purposes of the treaty are effectuated, I believe it will mean the opening of our shores to a flood of foreign oil." Industry leaders here pointed out under current regulations there is nothing to prevent any foreign company—or American company having foreign holdings—from "flooding the market right now—treaty or no treaty." Moreover, officials pointed out that as for Sinclair's statement regarding the probability of cartels, under the treaty agreement, paragraph (b) of Article 6 in the treaty specifically states:

"That no provision in this agreement shall be construed to require either government to act upon any report or proposal made by the commission (three men from the United States and three from Great Britain), or to require the nationals of either government to comply with any report or proposal made by the commission, whether or not the report is approved by that government."

Expanding on this clause in the treaty, one source explained that "you can't have a cartel when everyone can do as he jolly well pleases. Compulsion is the basis of cartels."

Concerning Sinclair's charge that the treaty would "grant aliens equal rights with citizens of the United States in the exploration and development of our public lands," and that this would be made possible by a specific clause in the treaty (subdivision (b) of Article 2, several high-ranking oil men quickly recalled the fact that this very same clause will enable United States interests to participate in operations the world over—something they were not always able to do because of British restrictions. The Red Line Agreement was cited as an example.

While the famous Red Line Agreement precluded Socony-Vacuum Oil Co. and Standard Oil Co. (New Jersey) from entering Arabia without sharing concessions with British and French interests, other United States companies, Standard Oil Co. of California and The Texas Co., profited by the arrangements.

Text of the Sinclair statements follows: (Sinclair is chairman of the Richfield Oil Corp. of California as well as president of Sinclair Oil Corp.)

"Notwithstanding its endorsement by some public officials and individuals and two organizations (presumably Sinclair refers to the American Petroleum Institute and the Independent Petroleum Association of America) connected with the petroleum industry, the revised Anglo-American petroleum agreement, in my opinion, is not in the national interest or in the interest of the petroleum industry, except perhaps some few companies having extensive foreign holdings. (Sinclair has an exclusive concession for exploratory rights in all of Ethiopia and has production in Venezuela and Colombia.)

"The treaty now pending before the Senate is subject to many of the same objections voiced against the original petroleum agreement of August 8, 1944, between the same parties, which ultimately lead to its withdrawal from the Senate.

Predicts Flood of Foreign Oil

"If the purposes of the treaty are effectuated, I believe it will mean the opening of our shores to a flood of foreign oil; it will be disastrous in its effects on the large independent section of the oil industry; it will bring us in competition with cheaply-produced foreign oil and will have harmful results for American labor as well as American capital. If the proposed treaty is merely a gesture and no serious effort is to be made to carry out its stated purposes, then of course there is no good reason for its existence. When and if we need foreign oil we shall be able to get it without this or any treaty.

"The assertion that no provision in the agreement is applicable to our domestic petroleum operations is sheer misrepresentation. Under subdivision (c) of Article 2, the proposed treaty would obligate Congress to enact legislation to regulate and control the domestic petroleum industry within the United States, as a means of directing its efforts generally to further the purposes of the agreement. It would prevent any action by states, state regulatory bodies or citizens in connection with 'the exploration for and development of petroleum resources, the construction and operation of refineries and other facilities, and the distribution of petroleum'—whenever such action be deemed to hamper or restrict, or to be inconsistent with, the purposes of the agreement.

"Subdivision (b) of Article 2 of the agreement would in my opinion require repeal or modification of the Federal Leasing Act so as to grant aliens equal rights with citizens of the United States in the exploration and development of our public lands.

"To accomplish the stated purposes and objectives of the proposed treaty, it will be necessary to establish a cartel system in international petroleum trade, which will involve controls, monopolistic practices, and combinations not now permitted by law or policy of the United States. If citizens of the United States are to participate in such a program, voluntarily or otherwise, Congress would be required to revise our antitrust laws so as to grant immunity to those participating in such practices. Cartels are obnoxious to American thinking.

"The foreign and domestic commerce of this country in petroleum do not exist in separate compartments. What happens in one field has an immediate effect in the other field. If our foreign commerce is to be allocated or in plain words cartelized, then similar domestic control is an inevitable consequence. If we are to abandon abroad or at home the principles of private initiative and free enterprise in the development of petroleum trade, which have made our petroleum industry the wonder of the world, we should do it with our eyes open—not by means of a treaty full of vagueness, uncertainty and ambiguity.

"In any event, the treaty should not be acted upon by the U. S. Senate until the Senate has received and considered the findings and recommendations of its special committee, headed by Sen. Joseph C. O'Mahoney, as chairman. This committee has been making an extensive investigation and study of petroleum resources and the production and consumption of petroleum and petroleum products within and outside the United States for the express purpose of 'the formulation of a national petroleum policy.' Should we ignore the committee's findings even before they are submitted? Examination of the proposed treaty will show that by its adoption the United States will be definitely establishing a national, as well as an international, petroleum policy. It would be doing this by indirection; I might almost say by subterfuge. Congress and the nation would be bound, not by their own considered action, but by the obligations of a treaty of the broadest implications.

"If we are going to determine national policy by treaty which would compel us to divide our markets at home and abroad with other nations, there is just as much reason for a coal, steel or shipping treaty as there is for an oil treaty."

Diverse Opinions Expressed On Anglo-American Oil Pact

HOUSTON. — A sharp division of opinion was making itself apparent in the oil industry this week on the issue of ratification of the Anglo-American oil treaty.

Statements by individuals and organizations indicated mounting interest in the hearings opening February 15 before the Senate Foreign Relations Committee. The O'Mahoney special Senate committee investigating petroleum resources generally is scheduled to begin hearings at the same time.

Opponents of the treaty who made themselves heard this week argued it would remove regulation of the industry from the states and that it would deprive American oilmen of foreign markets. Proponents, on the other hand, viewed the treaty as a means of conserving domestic reserves and preventing ungoverned exploitation of foreign fields.

Action of the directors of executive committeemen of the Independent Petroleum Association of America in reiterating the association's indorsement of the treaty drew a charge from C. V. Lyman, Texas oil operator, that rank and file members were never given opportunity for expression. Lyman is a member of a Texas committee which includes state and educational officials fighting the agreement.

C. E. Buchner, executive manager of the association, replied by pointing out that copies of the treaty were mailed to all members last autumn, that the original indorsement was made unanimously at a membership meeting in Tulsa in October and that the issue had been discussed in the association's bulletins.

Brown Lauds Document

Russell B. Brown, association counsel, earlier said the treaty was a "constructive step toward protection of our domestic industry from the chaos that could be caused by the ungoverned exploitation of foreign oil reserves." Answering this statement, Ghent Sanderford, cochairman of the Texas committee, said its effect would be the opposite.

"The treaty provides that the accessibility of crude should be on a nondiscriminatory basis," Sanderford asserted. "Our local consumption and market under the treaty would have to give way to Saudi Arabian and other Middle East oils, as they have 27 billion barrels reserve and we have 21 billion. . . ."

Writing in the monthly magazine of the American Institute of Mining and Metallurgy, George A. Miller, institute director, termed the treaty a "potential force in preserving peace." He pointed out the six advisers who went to London to aid in the negotiations had fought the first agreement but helped develop the present one. Miller said the treaty "should point the way to further similar trade treaties for other world mineral reserves and raw materials between this and the other countries of the world."

Subsidy Payments Will Be Continued Until June 30, OSA Rules

WASHINGTON. — The Reconstruction Finance Corp. has been directed by the Office of Stabilization Administrator to continue subsidy payments on stripper-well crude-oil production until June 30, 1946, "unless petroleum price ceilings are suspended prior to that date."

The announcement was made January 31, in a brief letter to RFC from Stabilization Administrator John C. Collet. No formal report or supporting material accompanied the decision, but the letter stated that withdrawal of the subsidy at this time would cause an intense demand for substantial increases in crude-oil ceilings. A rise in crude-oil prices would require a reorganization of the price structure for petroleum products which would be likely to cause an increase in the cost of living, Collet said, and such a development would be highly detrimental to the stabilization program.

The subsidy was put into effect August 1, 1944, to stimulate marginal production at a time when oil producers were exerting strong pressure for increased crude-price ceilings. Shortly after the end of the Japanese war the RFC asked for a review of the subsidy plan, and the matter has since been studied by various federal agencies. In making his decision Collet had before him reports from the RFC, Office of Price Administration, the Interior Department, and his own staff.

It is understood that RFC favored abandonment of the subsidy while while OPA insisted that it be continued, while the Interior Department suggested legislation to make the stripper-well subsidy a permanent part of a national conservation program. Several months ago the Office of War Mobilization and Reconversion, of which the Stabilization Administration is now a part, adopted a program of reduction and elimination of all subsidies paid in lieu of price increases, and is understood to have favored a reduction in stripper-well subsidies looking to their complete elimination within a few months. In recent weeks, however, the administration has reversed its position on subsidies and is moving to continue and restore them on a number of food and other important cost-of-living items.

The date of June 30, 1946, is the present expiration date of the price-stabilization act upon which OPA rests, and Congress now has before it legislation to continue the law for an additional year. Continuation of some form of price control is expected, but the law may be amended in many respects having a bearing on oil-price ceilings and the authority and need for subsidies. However, some speculation has been aroused over Collet's phrase "unless petroleum price ceilings are suspended prior to that date," since it carries the implication that there might be some changes in the oil-price structure prior to the expiration of the present law.

Five More Pools Receive Production Subsidy

WASHINGTON. — Five more oil pools have been added to the list of those receiving government-financed crude price increases under the stripper well premium payment plan. The increases, retroactive to January 1 by the Office of Price Administration order, apply to 593 wells with marginal production or high operating costs.

The five pools and the amount of the increase follow: Schubert pool, Richardson County, Nebraska, 35 cents. Earlsboro pool, Seminole County, Oklahoma, 13 cents. Blue Ridge pool, Fort Bend County, Texas, 11 cents. Taylor-Link pool, Pecos County, Texas, 20 cents. Toberg pool, Pecos County, Texas, 10 cents (raised from 25 cents).

Refinery-Gasoline Price Decline Appears to Have Been Arrested

ALTHOUGH tank-car prices of gasoline dropped another ⅛ cent in the Mid-Continent territory last week, there was general agreement that market conditions had been improved by the action of Office of Price Administration on January 24 in authorizing a temporary upward revision of kerosene and heating-oil prices in the Middle West, Gulf Coast, and East Coast areas.

The expressed purpose of OPA in raising the ceilings on these products was to halt the excessive manufacture of gasoline, which was dripping from overfilled storage tanks, and to stimulate production of kerosene and heating oils, for which the East and North were begging. This objective has been achieved in part, though doubt was manifested this week as to whether many major refiners would regard the ½-cent rise as sufficient incentive for making changes in their plant operations.

Informed observers say that although the large companies are receiving 5⅜ cents a gallon for regular-grade gasoline sold on contract in the Mid-Continent market, there is no difficulty in getting supplies from small independent outfits at 4½ cents in the spot market. A little is said to be moving at even ⅛ cent under that. To refiners who are letting their gasoline go at these lower figures, the additional ½ cent now available for kerosene and heating oils represents an opportunity.

These small operators have been dumping gasoline on a market already choked. Some of them had no recourse other than to keep on making an unneeded commodity in order to avoid losing their crude connections. With the higher prices now obtainable through OPA's action, they can afford to swing from gasoline to burner oils. To the extent that they are doing this—rather than by any general readjustment of refinery programs by the majors — a healthier tone is being imparted to the market.

The ⅛-cent drop in Mid-Continent tank-car gasoline has not been reflected in a corresponding drop in tank-wagon and retail quotations, and it was said that even another cut of the same size might be made without changing the price at the pump.

The burning-oil increases were urged on OPA by its refinery industry advisory committee which, in reference to the maladjustment of production, said:

"The situation is a striking illustration of actual and potential shortages being created by maintenance of rigid price ceilings on all products in a joint-product industry where potential over-all supply was clearly in excess of indicated over-all demand; with the actual total income to the industry being reduced because of falling below ceiling prices on some of the products."

The committee said the "crying need" is for flexible ceilings which can be adjusted to demand variations. The OPA adopted its recommendations for increases in burning-oil prices but turned down its proposed boost of ¼ cent for residual.

Overproduction and underconsumption in gasoline was further emphasized by federal gasoline-tax-collection figures which showed the total collected in December to be the lowest since August 1944. Collections of lubricating-oil taxes also dropped to a 12-month low.

All-Time High in 1945

Despite the drop in December collections, heavy receipts on both gasoline and lubricating oil earlier in the year, particularly from May through October, pushed the 1945 totals to new all-time highs. For 1945, federal taxes on gasoline amounted to $424,585,157 on gasoline and $97,037,309 on lubricating oil.

The continued critical shortage of burning oil and residuals was recognized in a message which Ralph K. Davies, deputy petroleum administrator, sent to refiners throughout the country. Pointing out no action was taken by OPA on residual ceilings, Davies said:

"It is recognized that supply situation on this product is especially tight in Districts 1 and 3, and refiners in those areas should do their utmost to increase residual product. I trust we can count on every refiner to augment fully his output of kerosene, distillate, and residual fuel during the critical first quarter period."

Residual fuel oil was reported nearly nonexistent in New York Harbor this week, and the situation was little better elsewhere along the East Coast. Kerosene and No. 2 fuel oil also were tight but not as scarce as residual. Gasoline stocks remained high with New York barge prices ranging from 7.425 to 7.9 for regular.

A weakness of several weeks in the natural gasoline market forced another ½-cent drop in the 26-70 grade product. The 18-55 grade was quoted at 4.2 compared to 4.8 previously.

Lack of demand from refiners was creating a serious situation for some natural gasoline manufacturers. Swelling inventories were becoming an acute problem. The latest ½-cent drop was the second in little more than a month for the Group 3 Oklahoma market. North Texas prices remained at 3 cents for 26-70 and at 3.6 cents for 18-55 with the spread between this market and the Oklahoma Group 3 thus reduced by the new cut.

More Wage Disputes Are Settled on Basis of 18 Per Cent Increase

THE 18 per cent wage-raise formula continues to provide the basis of labor agreements in the oil industry. A major group accepting the settlement during the week was the Baytown Employes Federation representing 6,000 workers at the Baytown refinery of the Humble Oil & Refining Co.

Strikes in other industries, however, held the threat of crippling the nation's petroleum production and distribution. An indication of the effect of the nationwide steel workers' walkout was the announcement of the Emsco Derrick & Equipment Co. in Houston that it has adopted a 40-hour week to conserve its diminishing steel supply without layoffs. Hughes Tool Co., operating on a single shift since the strike was called, sought to raise production by starting a second shift.

New York's supply of petroleum products was endangered early this week when tugboat workers struck after negotiations between the New York Tugboat Exchange and the A. F. of L. International Longshoremen Association collapsed. City officials considered emergency measures to meet the situation. Except for small supplies moved by transport and tank car, New York, Connecticut, and parts of New Jersey and New York State receive the most of their oil supplies by barge across the Hudson River.

The Humble agreement for the Baytown refineries calls for a 3 per cent raise retroactive to November 16 with the usual 4 and 6 cent shift differentials. A 15 per cent raise was approved last October 16.

Other oil workers agreements were at the Ponca City refinery of Cities Service Oil Co., 18 per cent increase beginning February 3 under an agreement with the Oil Workers International Union; and at the El Segundo refinery of Standard Oil Co. of California, 18 per cent increase retroactive to November 19 when the company returned to the 40-hour week.

California Standard, which raised wages of most of its employes 15 per cent last November, issued a statement saying "We have offered similar adjustment to other bargaining units and are prepared to put the same increases into effect with them and all other employes of the company when the necessary negotiations are completed."

In El Dorado, Ark., Lion Oil Co. announced a 40-hour week for its employes and a 15 per cent increase for those receiving less than $300 a month. Adjustment will be made for employes with monthly earnings exceeding $300.

In Los Angeles, employes in certain engineering, classification in sales, butadiene, and some other departments in the central division of the Southern California Gas Co. prepared to cast ballots in the next few weeks under supervision of the National Labor Relations Board on the question of representation by Southern California Professional Engineering Association, Gas Utilities Engineers Affiliate Unit No. 1, or Utility Workers Union of America, C. I. O., or neither.

Sinclair-Wyoming Posts Prices For Tensleep Oil

Sinclair-Wyoming Oil Co. recently has posted prices for Tensleep oil in the Bailey Dome field, Wyoming. The price is 70 cents for crude below 20° gravity, 2 cents additional for each degree of gravity up to 40°, and $1.12 for crude above 40° gravity.

U. S. and South America to Supply Bulk of French Oil

NEW YORK.—While the supply of American dollars will ultimately determine to a large degree the amount of crude and petroleum products which France will import during 1946, the French Purchasing Commission here estimates that about 3,500,000 tons (approximately 24,500,000 bbl.) will be imported—with the bulk coming from the U.S. and South America.

However, in view of the French Government's interests in Irak Petroleum Co. (roughly 25 per cent) it was pointed out that some of the crude and products would come from the Middle East.

At the present time, only four of the 15 petroleum refineries are in operation. Only one refinery in France, Socony-Vacuum Oil Co.'s Compagnie Industriale des Petroles, in Frontignan, survived either bombs or dismantling at the hands of the Nazis.

The prewar refining capacity in France was approximately 150,000 bbl. daily, with a cracking capacity of about half this amount

During the past year nearly all oil used in France was furnished by the U. S. and British armies. Only during the past few months has France commenced to import petroleum on its own. Of the 1,500,000 tons (about 10,500,000 bbl.) of crude and products imported, 1,340,000 tons (about 9,380,000 bbl.) came from the U.S.

Fuel oil and gasoline rationing still prevail throughout France, although all restrictions have been lifted on kerosene.

Journal Editor Speaks To New York Nomads

NEW YORK.—Approximately 150 members of the New York Nomads and their guests from the oil companies having headquarters here attended the first dinner meeting of the year here February 4.

John H. Baird, newly elected president of the organization, presided. John R. Suman, vice president of the Standard Oil Co. (New Jersey) was master of ceremonies.

A number of guests connected with oil operations outside the United States attended the dinner including: Malcom Berange, member French Supply Council, Paris; Juan Benassar, Argentine Government oil fields, Buenos Aires; F. L. Lassauze, director, and G. Semenoff, chief engineer, Societe Cherifiene des Petroles; A. J. Machicao, Bolivian Government oil fields, La Paz; R. B. B. Wrixon, Cia. de Petroles Shell de Colombia, Bogota; A. J. Domin, and A. J. Dodim, Bahrein Petroleum Co., Bahrein island.

C. O. Willson, editor of The Oil and Gas Journal, was the principal speaker. He gave a review of his recent several-month trip to the oil fields and refineries of the Middle East.

Index Ready Soon

The complete editorial index of The Oil and Gas Journal for 1945 is now is preparation, and will soon be ready. Due to the continued shortage of paper, it will not be published in a regular issue. The complete index, enlarged and improved and with more cross-references, bound separately, will be sent without charge to all subscribers requesting a copy. Address requests to Circulation Department, P. O. Box 1260, Tulsa.

DEATHS

George A. Wiese, 41, drilling contractor of Ridgeway, Pa., died January 28 from injuries received in an oil field accident.

A. K. Crichton, 72, early-day Oklahoma oil operator who devised several oil-production tools, died January 30 in Pryor, Okla.

George D. Parkinson, 61, oil and land attorney who held interests in the Isles district in Colorado, died recently in Salt Lake City.

Arthur Phillips, 69, president of the National Oil & Supply Co., died January 28 in Millburn, a New York suburb. He founded the National Oil Co. in 1901 and is a former president of the New Jersey Oil Trade Association.

Christopher B. Talbot, former Tulsa oil operator, died January 30 in Fayette, Mo.

William G. Vincent, 63, vice president and executive engineer of the Pacific Gas & Electric Co., died January 29 in San Francisco. He was also vice president of the Standard Pacific Gas Line Co.

James Franklin Hudson, pioneer oil operator in eastern fields, died January 26 in Bradford, Pa. As a boy of 6 he recovered waste oil floating down Oil Creek from the field just opened by the Drake discovery near Titusville. He was a boyhood playmate and lifelong friend of Theodore W. Barnsdall, Jr. He recalled selling newspapers to John D. Rockefeller on the streets of Titusville. Hudson retired several years ago.

Joseph Irwin Cromwell, 73, oil operator and widely known conservation advocate, died January 29 in Marlin, Texas. Cromwell is credited with the discovery of seven oil pools in Oklahoma, including one bearing his name in Seminole and Okfuskee counties. He began his career as a lease dealer in 1906 and drilled his first well six years later.

H. H. Temple, oil operator, died January 22 in Shreveport.

Eugene R. Black, 63, early-day independent Oklahoma oil producer, died February 4 in Tulsa.

H. R. Caldwell, 49, production official of Helmerich & Payne, Inc., died February 3 in Tulsa.

Burton O. Hindman, 73, pioneer Oklahoma oil producer who was with Indian Territory Illuminating Oil Co. for a number of years, died in Elyria, Ohio. He retired about 10 years ago from the oil business which he entered at the age of 14.

DIISOPROPYL

EVERYONE is now familiar in a general way with the role played by aviation gasoline in winning the war; the tremendous scale of manufacture achieved in a short time and the rapid progress made in the production of high-quality fuel components. With the war behind us, one chapter which "can now be told" relates to diisopropyl, which came into large-scale production in time to contribute to the aviation-fuel program throughout the last year of the war. Diisopropyl is significant postwar both as an engine fuel and in the evolution of petroleum processing.

Diisopropyl (2,3-dimethylbutane) is a hexane. It has a medium-high volatility; the boiling point is 136.4° F., the Reid vapor pressure is 7.35 lb. There are, altogether, five hexanes (Fig. 1) and, of these, diisopropyl and neohexane are the two which come in the high-octane-number category. Both, accordingly, are valuable as aviation-fuel or motor-fuel ingredients. From the aviation-fuel standpoint maximum calorific value is important, and in this respect the paraffins, including neohexane and diisopropyl, rank first among aviation-fuel components. Despite the seemingly slight difference in structure, these two hexanes differ greatly in several properties. Neohexane has an exceptionally high lead response, being somewhat better in this respect than diisopropyl. While neohexane is unusually stable to oxidation, even for a paraffin, diisopropyl will undergo oxidation by air to a peroxide even at ordinary temperatures. This oxidation fortunately is prevented by adding a very little inhibitor. Chemically speaking, the difference between these two hexanes may be largely due to the fact that the neohexane molecule has no tertiary hydrogen atom, while diisopropyl has two on adjacent carbon atoms. The reactivity of diisopropyl suggests that a study of its chemical possibilities may be fruitful.

Diisopropyl is unique among the hexanes in giving a high knock rating under rich-mixture supercharge conditions, a property which only a few of the paraffins, notably triptane,

THE AUTHORS

R. C. Alden has been research director for Phillips Petroleum Co. since 1933, having been made a senior chemist in 1925 and assistant director in 1930. Educated at Lehigh University, he entered the oil business in 1920; worked as research chemist for Chestnut and Smith Corp., was partner in Seeley-Oberfell Engineering Corp. and active in charcoal absorption engineering and analogous fields until he joined Phillips' young research department in 1925. He has been one of the leaders in much of that company's pioneering research and development accomplishments.

Fred E. Frey is associate director of research for Phillips Petroleum Co. in charge of the fuels and lubricants division. He obtained the B.S. degree from Wooster College in 1922, served as an instructor in chemistry a year, and obtained the M.S. degree from Ohio State University in 1924. After a 3-year period as chemist with the Bureau of Mines he joined the Phillips organization. He is one of the nation's outstanding authorities on the reactions of hydrocarbons and has made some of the greatest contributions in this field in synthetic rubber, aviation fuels, and the synthesis of components for these and other products.

Harold J. Hepp has been in the employ of Phillips Petroleum Co.'s research department since 1927, a year after his graduation from Miami University, Ohio. He has been associated closely with developments in the conversion of hydrocarbon gases including thermal cracking and polymerization in both low and high-pressure fields; thermal alkylation such as in the synthesis of neohexane which his company does on a commercial scale; catalytic polymerization, and catalytic alkylation of hydrocarbons.

Leo A. McReynolds is senior section chief of the fuels test division of Phillips Petroleum Co.'s research department, having joined the company in 1939. He obtained a B.S. in chemical engineering, South Dakota School of Mines, in 1937; M.S. in chemistry, South Dakota University, in 1939. He worked as a chemist in the state chemical laboratory the 2 years during which he worked for the master's degree.

exhibit but which is important in aviation fuels when used at high-power-output levels. The aviation-fuel properties will be further discussed.

Diisopropyl occurs naturally in crude oil[1] and is formed to some extent in the catalytic isomerization of hexane.[2] However, in these cases the amount present is ordinarily small and the separation from close-boiling methylpentanes is difficult and expensive.

The first manufacture of diisopropyl on a large commercial scale was begun by Phillips Petroleum Co. at its Phillips, Tex., plant in August 1944. The process employed is based on alkylation. The raw materials for the process are ethane, propane, and n-butane. Ethane and propane are subjected to low-pressure cracking to produce ethylene, and n-butane is isomerized to produce isobutane. The ethylene and isobutane are then reacted together in the presence of an aluminum chloride catalyst to yield diisopropyl.

From the broad viewpoint, the petroleum industry has become aware of the importance of increased efficiency in the utilization of petroleum reserves, both crude oil and natural gas. Diisopropyl manufacture is a step in this direction in two respects. Ethane and propane which hitherto have been put to limited use, except as ingredients of fuel gas, liquefied gas, and for carbon-black manufacture, become a source of ethylene for conversion into diisopropyl. A further gain in the same direction results from the high antiknock rating of diisopropyl, which permits a high fuel efficiency when taken advantage of in the internal-combustion engine.

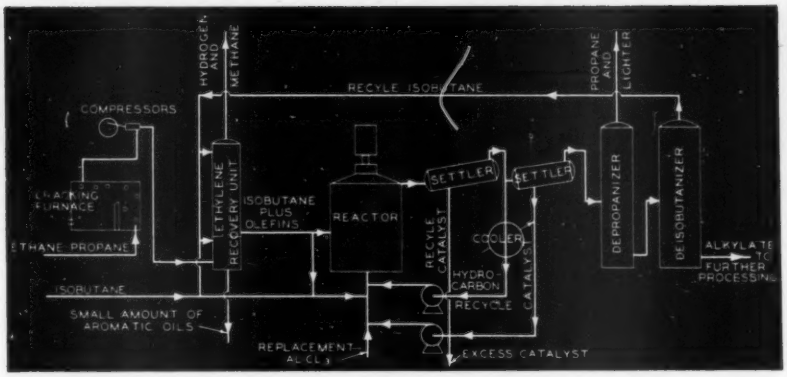


Fig. 3—Simplified flow diagram of diisopropyl unit

More specifically, from the standpoint of crude-oil refining, diisopropyl manufacture as an addition to refining operations opens up the possibility of striking a better balance among conversion processes to obtain an increased motor-fuel yield from crude oil at a given octane-number level. Catalytic cracking is a source of high-octane fuel and olefins for acid alkylation. Low-pressure thermal oil cracking operations also yield motor fuel of higher octane number than conventional pressure cracking, with less fuel-oil production but a greater loss to gas which is rich in ethylene. Through the use of the ethylene in the diisopropyl process an over-all gain both in yield and quality of motor-fuel results. The familiar use of HF or sulfuric acid for propylene, butylene, and amylene alkylation, of course, goes part way in the same direction. For a given over-all octane-number level it becomes possible with diisopropyl to reduce the use of reforming for octane improvement with its attendant conversion losses. In such a context the use of natural gasoline should be considered for supplying both blending ingredients and conversion stocks for alkylation processes. Such a trend toward more processing undoubtedly means higher investment costs, but this tendency is evident in oil-refining generally, as higher-octane levels with efficient crude utilization are sought.

From the aviation-gasoline viewpoint, the volume requirements for some years to come are expected to fall short of the production capacity achieved during the war. Should the need arise, however, the diisopropyl process makes possible a greater volume of aviation gasoline per barrel of crude, both through the utilization of ethane and propane from natural gas and through the possible inclusion of otherwise submarginal gasoline stocks with the diisopropyl. As will be pointed out in more detail, diisopropyl is particularly well adapted for the blending of extreme-

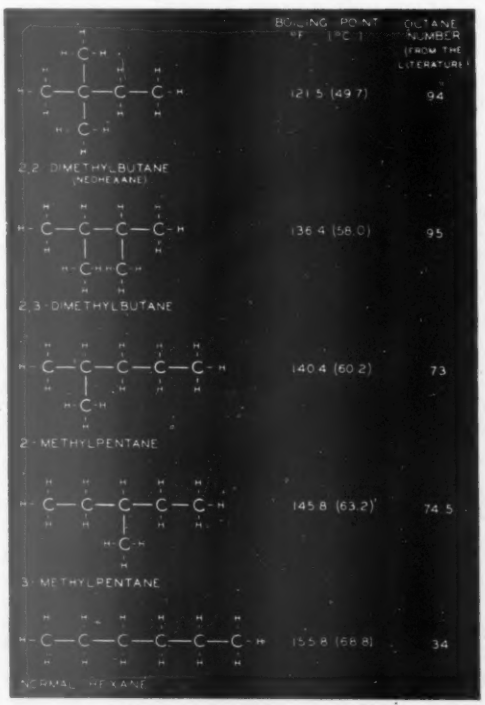
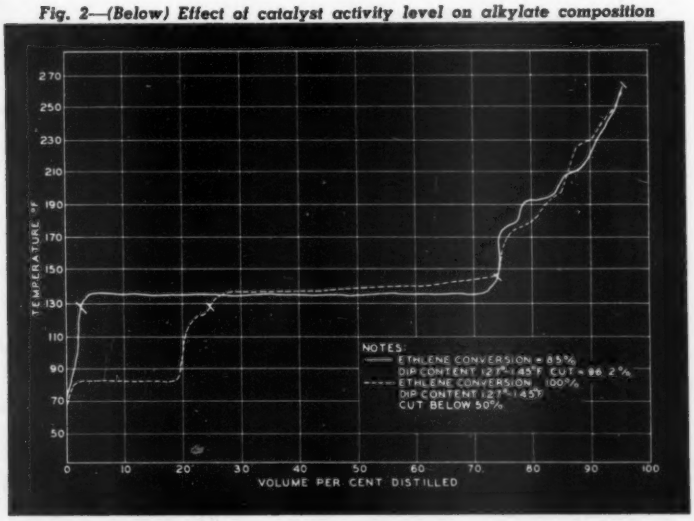


Fig. 1—(Left) The hexanes. Values for octane numbers are by Motor Method except for normal hexane, which is by Research Method

Fig. 2—(Below) Effect of catalyst activity level on alkylate composition



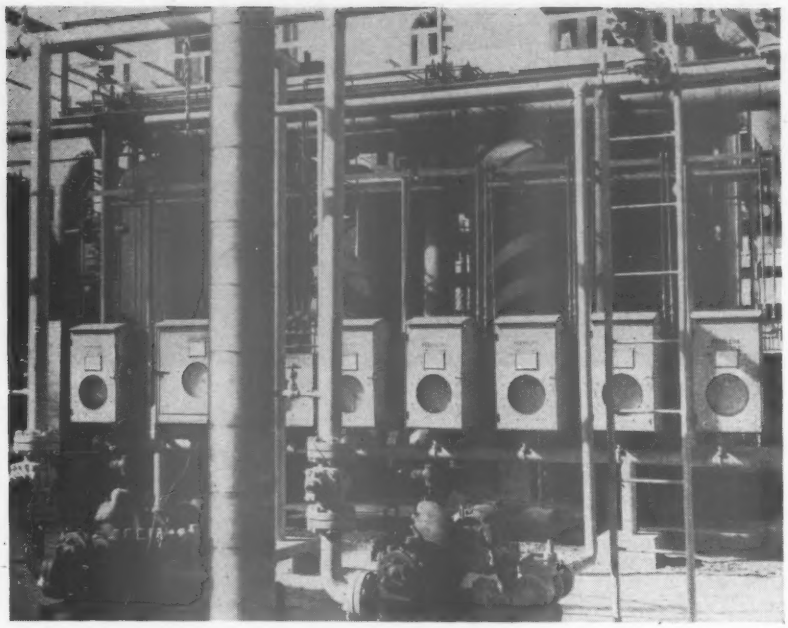


Fig. 4—Reactors and some of the control instruments. Phillips plant

ly high-quality aviation gasolines, well above the 100-octane level.

Chemical Aspects of the Alkylation to Produce Diisopropyl

Chemistry.—Ethylene and isobutane will react in the absence of catalysts at elevated temperatures and pressures to produce neohexane (2,2,-dimethylbutane) (3,4) or in the presence of catalysts of the Friedel-Kraft type, including aluminum chloride and boron trifluoride-nickel-water to produce diisopropyl (2,3-dimethylbutane) (5,6).

The alkylation with aluminum chloride is a fairly clean-cut reaction under proper conditions; 75 to 85 per cent of the ethylene going to diisopropyl and most of the remainder to secondary alkylation products. The over-all reaction may be written:

$$CH_2{=}CH_2 + CH_3{-}\underset{\displaystyle CH_3}{\underset{|}{CH}}{-}CH_3 \longrightarrow CH_3{-}\underset{\displaystyle CH_3}{\underset{|}{CH}}{-}\underset{\displaystyle CH_3}{\underset{|}{CH}}{-}CH_3$$

Recent experimental studies have done much to elucidate the basic reaction mechanism. The reaction is thought to proceed by the following route:

A small proportion of the over-all reaction proceeds by Equation 1 to generate tertiary butyl chloride which serves as an intermediate to effect the main conversion of ethylene and isobutane to diisopropyl by the reactions shown in Equations 2 and 3. The hydrogen-halogen transfer reaction such as appears in Equations 1 and 3 was demonstrated by Bartlett, Condon, and Schneider[7] for a variety of alkyl halides and isoparaffins, while reactions 2 and 3 were shown to take place by Schmerling,[8] who proposed the above steps for this reaction.

Reaction variables.—A laboratory study of the reaction was made, using a technique generally similar to that described for acid alkylation in published articles. A dried mixture of olefin with isobutane was passed continuously through a reaction vessel of 560-ml. capacity in which the hydrocarbon was mechanically agitated by an impeller with liquid aluminum chloride-hydrocarbon complex, generated in the process, while maintaining the desired conditions of time and temperature to effect the alkylation. The effluent from the reactor was passed through a separating chamber in which the suspended catalyst settled out, and was returned to the reactor. The hydrocarbon was withdrawn, washed with caustic, and subjected to analysis. Catalyst activity was maintained at the desired level by introducing aluminum chloride in known amounts at spaced time intervals, withdrawing catalyst complex as needed to maintain a relatively constant amount in the reactor.

For brevity only a few of the data obtained will be shown in detail, although the discussion takes into account data not shown as well.

$$(CH_3)_2CH + C_2H_4 + HCl \xrightarrow{(AlCl_3)} (CH_3)_3CCl + C_2H_6 \quad (1)$$

isobutane — ethylene — hydrogen chloride — t-butyl chloride — ethane

$$(CH_3)_3CCl + C_2H_4 \xrightarrow{(AlCl_3)} (CH_3)_3CCH_2CH_2Cl \quad (2)$$

t-butyl chloride — ethylene — neohexyl chloride

$$(CH_3)_3CCH_2CH_2Cl + (CH_3)_2CH \xrightarrow{(AlCl_3)} (CH_3)_2CHCH(CH_3)_2 + (CH_3)_3CCl \quad (3)$$

neohexyl chloride — isobutane — diisopropyl — t-butyl chloride

1. Feed Composition

(a) External ratio of isobutane to olefins.—At a high ratio of isobutane to olefin the content of diisopropyl in the alkylate approaches a maximum, while at low ratios secondary alkylation becomes extensive, producing higher-boiling alkylate. The data shown in Table 1 are limited to an intermediate range. Periods 31-3 and 28-3 show that a decrease of 2.6 per cent in diisopropyl content of the alkylate accompanied a reduction of isobutane-olefin ratio (molar) from 5.4 to 4.8, computed from feed compositions shown.

(b) Effect of propylene.—The alkylation of propylene with isobutane yields isoheptanes as the primary product, and experiments (not reported in detail) with varying ethylene-propylene ratios at a constant molal ratio of isobutane to olefin in the total feed of about 5.6 gave, for 0, 19, and 27 weight per cent propylene based on total olefin, 3.4, 10.7, and 23.2 per cent of heptanes in the alkylate. In these experiments 93 to 96 per cent conversion of the olefin was maintained and a reaction temperature of 130° F. used.

(c) Effect of normal paraffins.—Many experiments (not reported herein) established that moderate concentrations of propane and n-butane, under reaction conditions suitable for diisopropyl formation, did not participate markedly in the reaction. The principal effect to be expected from their inclusion, would be a decrease in effective contact time in the reactor.

(d) Effect of HCl.—HCl is an active promoter of catalyst activity, but the amount of HCl in the reactants was found to have very little effect on alkylate quality under otherwise correct conditions. The chlorine fixed in the alkylate as organic chlorides was found to be increased with increase in HCl concentration in the reactants. This is an accord with findings communicated to us to Gulf Research & Development Co.

2. Catalyst Activity

Catalyst activity may be measured by its ability to convert ethylene in the alkylation. Activity can be increased at a given reaction temperature either by increasing the rate of addition of fresh aluminum chloride to the reactor or by the addition of HCl or substances capable of gen-

erating HCl. An insufficiently active catalyst fails to cause the desired ethylene conversion, while an overactive catalyst not only causes nearly complete ethylene conversion, but also results in a low-quality alkylate. In the experiments here reported (Table 1) the highest-quality alkylates were obtained when ethylene conversions were in the range of 92 to 94 per cent. However, in actual plant operation, ethylene conversions are usually maintained in the range of 95 to 98.5 per cent, the better ethylene utilization and additional alkylate obtained more than balancing the slight loss of product quality due to the somewhat severe reaction conditions.

Low ethylene conversion not only results in loss of alkylate volume due to the escape of ethylene, but also to loss of alkylate quality due presumably to ethylene polymerization and subsequent alkylation of the polymers. This results in an alkylate containing decreased percentages of diisopropyl and increased C_7 and higher products. Referring to Table 1, with ethylene conversions of 68, 84, and 92.8 per cent the weight yields of diisopropyl, referred to ethylene, were 1.83, 2.15, and 2.19 respectively, while the weight per cents of C_7 and higher in the alkylate were 36.9, 28.2, and 25.5. As ethylene conversion is still further increased by increasing catalyst activity, secondary reactions involving the alkylate become noticeable. Pentanes are formed in increasing amounts and the percentage of diisopropyl in the total hexanes fraction decreases. In Table 1, as the ethylene conversion was increased from 92.8 to 98.3 per cent the pentanes content of the alkylate increased from 2.4 to 5.6 per cent. The diisopropyl weight yield referred to ethylene went from 2.19 to 1.88. In a later paragraph the effect on alkylate composition is discussed.

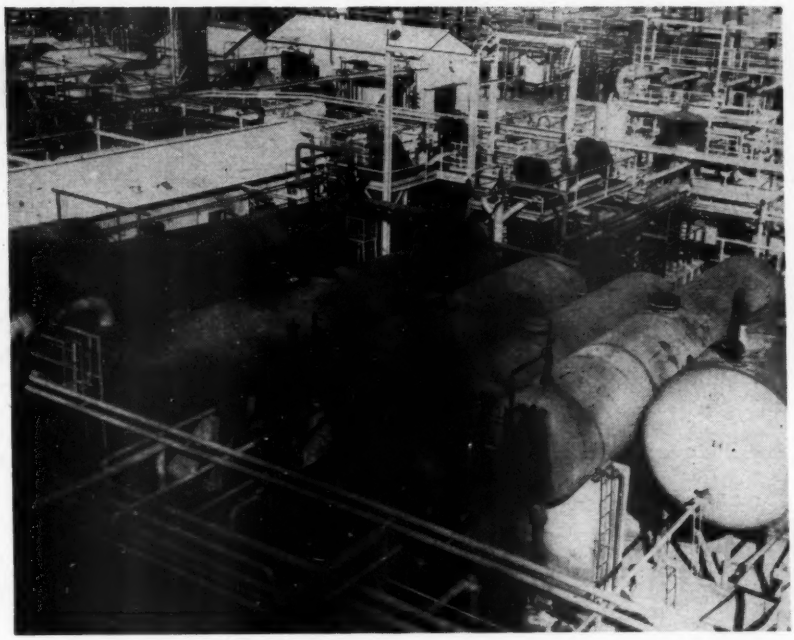


Fig. 5—General view of plant area at Phillips' diisopropyl plant

TABLE 1—LABORATORY ETHYLENE-ISOBUTANE ALKYLATION DATA
At 130° F. and 300 psi. (reactor volume 560 ml.)

Run No.	28				31				
Period—	1	2	3	4	1	2	3	4	5
Flow rate, lb./hr.	1.17	1.34	1.29	1.20	1.11	1.10	1.16	1.14	1.21
Composition of fresh feed, wt. per cent:									
Ethylene	6.9	6.45	6.17	6.80	6.87	8.72	6.65	6.74	6.93
Propylene†	1.1	1.10	1.00	1.05	1.38	1.06	1.25	1.10	1.27
Propane†	9.0	1.57	8.91	9.10	8.80	8.72	8.55	8.56	8.67
Isobutane	75.95	83.50	76.80	75.80	74.25	73.55	75.45	75.46	74.80
n-Butane†	7.0	7.30	6.80	7.20	8.70	7.95	8.10	8.14	8.33
HCl	0.05	0.08	0.32	0.05	0.00	0.00	0.00	0.00	0.00
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mole ratio: iC_4H_{10}/olefin	4.8	5.4	5.5	4.9	4.6	3.9	4.9	5.0	4.7
Catalyst:									
Ml. in reactor	71	90	141	232	170	173	145	167	156
Viscosity§	260	600	400	60	140	175	200	370	170
Charges, lb:									
Fresh feed	93.51	124.0	156.3	238.2	57.0	40.3	59.5	134.9	76.4
$AlCl_3$	0.252	0.215	0.259	0.538	0.238	0.168	0.249	0.147	0.091
Products, lb:									
C_4 and lighter	59.39	88.27	105.8	177.4	39.76	29.41	45.08	99.58	56.78
Alkylate	11.82	20.12	24.8	44.9	12.44	11.35	11.94	29.80	18.09
Per cent recovery	76.20	87.40	83.5	93.3	82.60	101.30	95.80	96.00	98.00
Conversions, per cent:									
Ethylene	68	84	92.8	89.2	81.5	87.4	92.0	96.2	98.3
Propylene	100	100	100	100	100	100	100	100	100
Alkylate yields:									
Per lb. $AlCl_3$	8.20	16.40	16.80	14.60	9.20	12.00	8.50	35.80	35.10
Per lb. olefin*	2.62	2.72	2.75	2.79	2.78	2.71	2.76	2.81	2.78
Efficiency¶	1.83	2.15	2.19	2.17	2.31	1.93	2.18	2.07	1.88
Composition of alkylate, wt. per cent:									
Pentanes	3.1	1.9	2.4	3.6	3.1	3.7	3.9	4.7	5.6
Neohexane	0.2	0.6	0.7	0.6	0.5	0.7	0.4	0.8	0.6
Diisopropyl	58.1	66.5	67.8	66.1	67.1	63.9	65.2	63.2	59.4
Other hexanes‡	1.7	2.8	3.6	4.3	3.0	2.6	2.7	5.4	7.7
Heptanes	13.5	11.6	10.2	11.2	9.0	8.0	10.4	9.2	10.2
Octanes	14.4	11.0	8.5	10.0	12.8	15.3	12.2	12.7	12.0
Heavier	9.0	5.6	6.8	4.2	4.5	5.8	4.2	4.0	4.5
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*Corrected for low recoveries. †These components are included to simulate commercial plant feed stock. ‡Mainly 2-methylpentane, although infrared absorption also shows 3-methylpentane and n-hexane to be present. §Centistokes at 100° F. ¶Pounds diisopropyl per pound ethylene reacted.

3. Yields

The yield of total alkylate per pound of olefin reacted will vary with the olefin composition and the molal ratio of isoparaffin to olefin, but for the feed composition of Table 1 it was in the range 2.7 to 2.8 lb. per pound of olefin and 1.5 to 1.6 lb. per pound of isobutane consumed. As the table shows, the total alkylate contained 67 weight per cent diisopropyl under favorable reaction conditions.

4. Catalyst Life

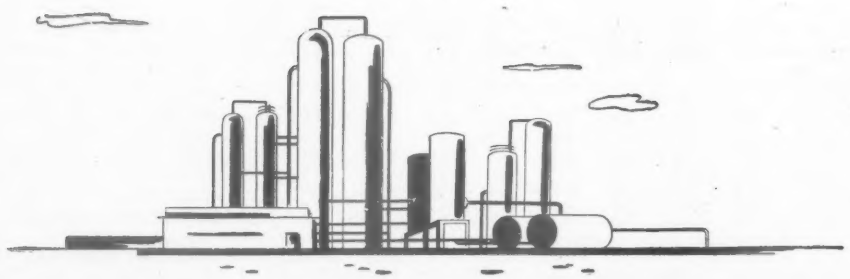
The yield of total alkylate per pound of aluminum chloride added to maintain catalyst activity ranged from 14 to 30 gal. per pound, the consumption of catalyst being highest at low ethylene conversions.

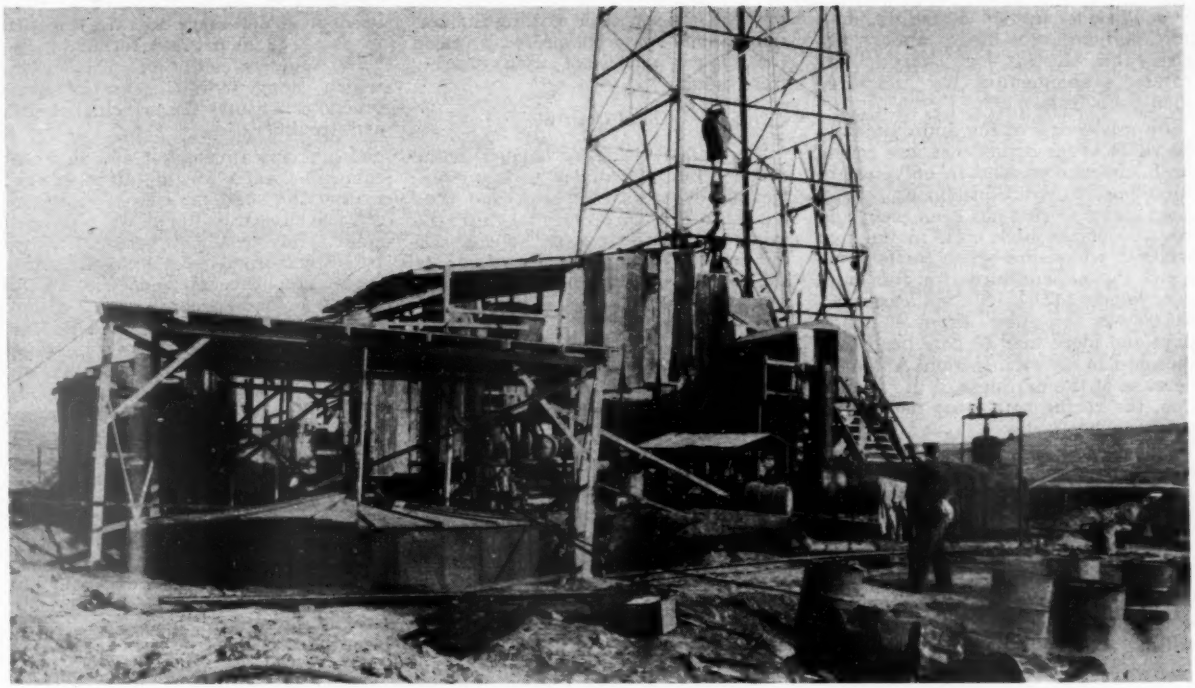
5. Alkylate Composition

A fractionation curve for a total alkylate made during period 2 of run 28 (Table 1) is shown by the solid line in Fig. 2. Diisopropyl is the major component. The close-boiling methylpentanes, largely 2-methylpentane, distill with diisopropyl and appear as impurities in the diisopropyl fraction. Other hydrocarbons present in significant amount are isopentane, dimethylpentanes, and isooctanes. Close fractionation supplemented by spectrometric analysis and properties determinations showed the heptanes

(Continued on page 103)

We Go A Long Way To





Oil-base mud installation in Rangely field using 500-bbl. steel tank (left foreground) as circulating pit. Small, skid-mounted boiler at right is used to generate steam for heating coils in tank

Completions in Rangely Field Are Complicated by Tight Formations

by Neil Williams

COMPLETION of wells in the Rangely field of northwestern Colorado involves a number of special considerations. Chief of these concern the exceptional hardness of the producing formation and its relatively low permeabilities. Naturally slow to give up oil, the formation necessitates unusual care in completion of wells to protect the sand face from outside contamination and that means be taken to induce greater porosity if maximum productivity is to be attained.

Technically, the operation of well completion begins with the actual drilling of the formation since the methods employed in penetrating the section has a direct bearing on how clean the sand is kept. In view of its "tightness," the sand is particularly susceptible to being sealed off with drilling mud or "logged" with water infiltration from the mud. A factor in this is the hardness of the formation which substantially retards drilling and lengthens the time the sand face is exposed to the drilling fluid.

Because of complications in mud control arising in the upper part of the hole (The Oil and Gas Journal, January 19, 1946, page 70) and the desire to produce wells through open hole in oil sand, field practice calls for setting and cementing the production casing string before drilling the producing formation. This leaves the drilling and completion in the producing section a phase of operation in which the practices followed are entirely independent of conditions encountered in the rest of the hole.

Producing Formation

Seven-inch casing is run for the production string, allowing 6⅛-in. hole to be drilled into the oil sand. Drilling of this hole, and also final completion of the well are done with rotary tools. As a means of better determination of most effective porosity and permeability, of which there is very little information to date, the use of cable tools has been considered by several operators. So far, however, this has not been undertaken.

The producing formation is the Weber sandstone of Pennsylvanian age, top of which is found at depths ranging from 5,400 to 6,000 ft., depending on structural position. A gas cap with oil contact at a subsea depth of 305 to 310 ft. is the controlling factor in the depth at which the production casing string is set. However, since the gas cap is relatively small in area with the oil contact less than 75 ft. below the top of the sand at its highest points, most wells are equipped with casing at or near the top of the section.

Saturation is present in zones of varying porosity and permeability irregularly distributed through a section of approximately 600 ft., all of which is taken in for completion. Average effective porosity is estimated to be about 30 per cent of the total section although, because very little coring has been done, it generally has not been possible to know definitely the permeability and poros-

ity conditions. In lieu of coring, determinations are based almost entirely on electric logs and drilling rates, supplemented by scattered drill-stem tests.

In only 4 or 5 of the approximately 30 wells so far drilled has any coring been undertaken, and in only two of these has the entire producing section been cored. Coring has been restricted because of the high cost. In the two wells in which the entire section was cored the expenditures for this purpose were $32,000 in one case and $40,000 in the other. From 40 to 50 days and more than 60 core heads are required to core the section. At times, because of the hardness of the formation, the coring rate is no more than a few inches a day.

Coring time, as is all rig time spent on the well after cementing the production casing, is charged to the operator on a day basis generally at $650 per day. In the extra time spent for coring, not only are completion and putting the well on production delayed, but being in the hole that much longer increases the time the drilling fluid is held on the sand face and the danger of closing off the sand pores.

To drill the section without coring, and complete a well takes from 20 to 25 days, barring unexpected trouble and shutdowns, and 20 to 25 bits. After drilling out plug in the 7-in. production string preparatory to going into the oil sand, the mud is thoroughly conditioned to treat out the cement and build the special mud properties needed for drilling the section. Some operators prefer to clean the system and start with entirely fresh mud.

Mud Control

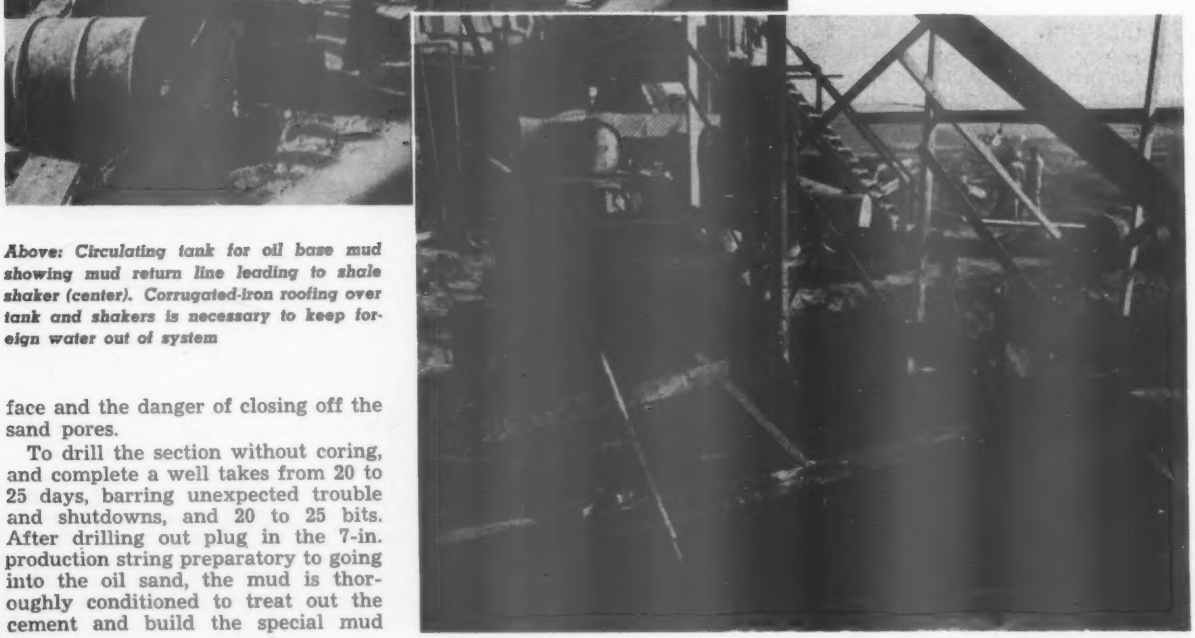
The primary quality needed in the drilling fluid is ability to keep water out of the sand pores, and thus minimize the danger of "logging" the sand and preventing it from giving up the oil, and preventing the mud solids from building up a seal on the sand face that would be hard to remove. For this, a low-water-loss and light-weight mud is a requisite. The maximum water loss now being permitted is 3 cc. in 30 minutes at 100 psi., while mud weight is limited to 8.9 to 9 lb. per gal. Fortunately, so far as the mud weight is concerned reservoir pressure is relatively low (approximately 2,700 psi.) and can be held easily by mud of that weight.

In the case of water-mixed mud, a good gel clay having high colloidal property is used as a base. The exceptionally low water loss is attained by addition of starch products or pavrite. When starch products are used, it is necessary to raise the pH to about 12 to prevent fermentation. This requires addition of caustic, which along with the use of quebracho constitutes the principal chemical treatment.

A a possible means of avoiding the chance of water logging or otherwise sealing the sand pores that exists in the use of conventional water-mixed muds, and the consequent difficulty sometimes involved in cleaning the sand face, several operators lately have been experimenting in drilling the sand with oil base mud. So far this type mud has been used in three wells. As yet it is not possible to form any definite conclusions as to the benefits in increased well productivity in respect to the added costs. One well so completed made a much better producer than its offset, in which the sand was drilled with conventional mud, but since the permeability and extent of effective saturation varies considerably between wells it is hard to determine whether the greater productivity can be attributed directly to the use of the oil-base mud.

The changeover to oil-base mud on these wells called for several special preparations which were made during the time the rigs were shut down waiting on cement of the production casing to set. These included the provisions of covering for all mud tanks and open ditches to keep any foreign water or other contamination out of the system, and installation of steam-

Below: Drilling with oil-base mud at Rangely showing shale-shaker discharge into opening cut in top of 500-bbl. steel circulating tank. Shaker is driven by single-cylinder gas engine

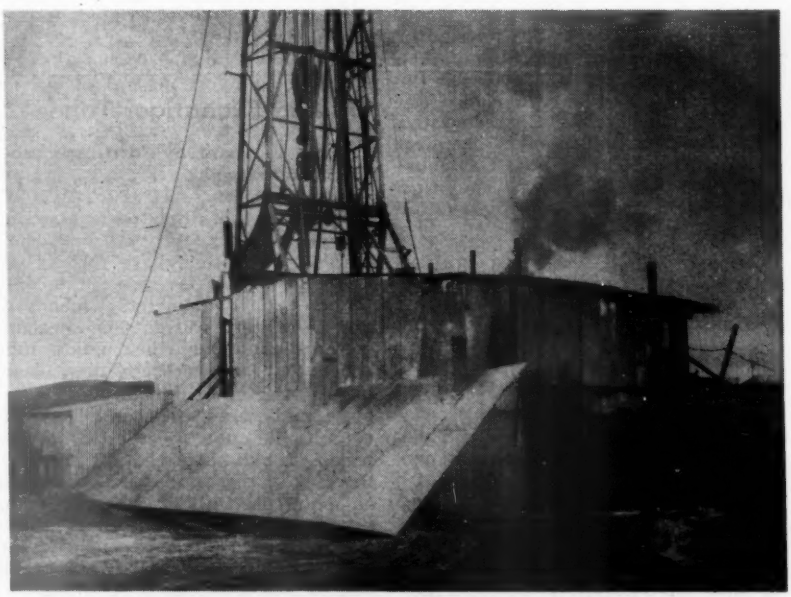


Above: Circulating tank for oil base mud showing mud return line leading to shale shaker (center). Corrugated-iron roofing over tank and shakers is necessary to keep foreign water out of system

Oil-base-mud circulating tank and shale shaker installation at Rangely showing mixing lines (left) and pump suction line (lower right)

generating equipment and coils in the mud tanks to heat the suction stream, which is required to maintain the desired viscosity. On one job a Bettis steamer was used for the latter purpose, while on the others small boilers were set up.

Accompanying pictures show some of the special installations made on two of the wells. On one, a 500-bbl. steel stock tank was moved in for the circulating pit, replacing earthen mud pits which had been used in drilling the hole to the oil sand. The tank was set in an excavation at a level that permitted mud returns over the shale shaker to empty directly into an opening in its top. Its location was at the side of the rig adjacent both to the discharge of the mud return line and shale shaker, and also to the pump suction lines. On the other well two conventional rectangular, open-top steel mud tanks, set end to end at the side of the rig were used for the circulating pit. These, and the shale shakers, mounted at the mud return line end of the tanks, were covered with a corrugated-iron lean-to roof.



Corrugated iron housing for steel mud pits and shale shakers on Rangely well drilling with oil base mud. Two ventilators in top prevent accumulation of vapors inside housing. On this job, Bettis Steamer (located in separate housing) generates steam for heating coils in circulating pits

The mud used consisted of approximately 300 bbl. of oil base material (Talloil) mixed with 500 sacks of oyster-shell flour. The cement plug in the 7-in. casing first was drilled out with the regular mud, which then was replaced in the system with the previously mixed oil base mud. In the drilling it was desired to maintain a viscosity of 50 seconds (at 500 cc. out), which required heating the stream to a temperature of about 90° F. This was done by the steam coils in the circulating tank. Further control was effected by adding Talloil to cut viscosity, and sodium silicate to build it up. If foreign water entered the system, salt was added to counteract the contamination.

Final Completion

General practice, particularly on wells located in or near the gas-cap area, is to make a drill-stem test after drilling about 4 or 5 ft. into the sand to determine the effectiveness of the gas shutoff. If gas is tested, indicating a possible cement-job failure and channeling, or possibly that the casing might have been set too high, it is preferred to correct the trouble at this time rather than after the entire section is drilled and the well completed. In a repair job after the entire section is drilled, the drilling mud would have to remain on the sand face a much longer time than otherwise would be necessary and thus further endanger the final successful completion of the well and its productivity. There also is the added danger of cementing the sand face. If gas shutoff is effective, the section then is drilled to its completion depth, and electric log taken.

Mud acids are being used extensively as a means of cleaning the sand face. Also, shooting is resorted to to open the tight formation. From 1,200 to 1,500 qt. of explosive, usually in solid form, is the average charge, but as much as 1,900 qt. has been used in some wells, making cleaning out the debris a major job. With 2½-in. tubing run, the mud is displaced. Although some wells then will come in by themselves, swabbing generally is necessary.

All wells to date have flowed naturally. Initial potential production of most wells is from 300 to 500 bbl. daily through ¼-in. or ⅜-in. chokes on the tubing. The best well so far flowed initially at the rate of 1,000 bbl. daily. Tubing flowing pressures range from 190 to 250 psi., while shut-in. casing pressures build up to from 600 to 1,075 psi.

QUESTIONS on TECHNOLOGY

by W. L. Nelson
Consulting Engineer

Sulfur in Lubricating Oils

What is the effect of sulfur in lubricating oils? Our oils contain more than the amount allowed by Navy specifications.—G. S. C.

Little on the effect of sulfur in lubricating oils has been published and even such information as is available may in many instances be attributed to other factors than sulfur content. Knowledge gained in the last few years concerning the deliberate addition of sulfur compounds to oil in order to make extreme-pressure lubricants indicates that sulfur may sometimes be beneficial. The behavior of the sulfur compounds naturally present in a lubricating oil may, however, be entirely different from the behavior of the compounds that are added to end point or hypoid-gear oils. The compounds added to gear lubes are noncorrosive at room or operating temperatures but become corrosive at 250°-400° F. Thus, if any bearing surfaces are too rough, these surfaces become hot and are smoothed by the corrosive action of the sulfur compounds. See Questions on Technology, April 7, 1945, page 97, entitled "Corrosion Tests of Gear Lubes—Their Significance."

In general, petroleum stocks do not cause severe corrosion in refineries until temperatures in excess of 400° F. have been attained and not violently corrosive until the temperature is 700°-900° F. This indicates that the sulfur compounds naturally present in lubricating oils may be of the same nature as those used in manufacturing gear lubes. However, great care would be required to be certain that harmful sulfur compounds were removed from the oil.

Likewise, Mizushima and Yamada in Petroleum Times, Volume 22, page 900, November 9, 1929, find that sulfur may act as an antioxidant, particularly with respect to transformer oils. They state, "though sulfur and its compounds have been hitherto considered to be one of the important factors which accelerate the oxidation of petroleum oils, this consideration has been derived only from the results of the experiments upon the sludge-forming character of the oils."

Notwithstanding the above-mentioned idea of accelerating action of sulfur, the authors suggested that sulfur in petroleum oil may act as an antioxidant and this suggestion was ascertained by the following experiments:

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"Sulfur, 0.1 per cent, was added to a refined, white transformer oil containing 0.023 per cent sulfur and oxidized with oxygen at 86 cm. pressure for 100 hours at 120° C. A parallel test was made with unmodified oil. Comparing these two products of oxidation with their acidity, tar and water formation, the result was that, whereas the oil containing no extra sulfur was strongly oxidized with the formation of large quantities of tar and water, the oil with added sulfur resisted oxidation in almost perfect degree.

"As the results of another experiment, it was shown by the addition of a small percentage of sulfur, paraffin wax may be also guarded against the oxidizing influence of oxygen under the same condition as given above."

If natural sulfur becomes partly corrosive at 300°-500° F. corrosion of cylinder walls and pistons might be expected, and such seems to be the case according to Merrill, Moore, Jr., and Bray in "Service Characteristics of Motor Oils as Related to Chemical Composition," The Oil and Gas Journal, June 13, 1935, page 59. They find that wear is greater with high-sulfur oils:

Per cent sulfur	Mg. iron per 1,000 miles
0.2	100
0.4	130
0.6	200
0.8	315
1.0	500
1.2	800

but are not sure that sulfur is the main cause of the engine wear shown in the tabulation, as:

"Although the values for the blends containing aromatic fractions appear to indicate a relationship between wear and sulfur content, the validity of this relationship is brought into question by the marked deviation of the naphthenic blends from the curve. It is possible that this deviation is due to differences in the activity of sulfur in different forms of combination, but it appears much more probable that it is the low paraffinicity of the aromatic fraction, rather than the sulfur content which is responsible for the poor lubricating value of these fractions."

Viscosity Loss by Crankcase Dilution

When dilution of lubricating oil occurs in an automotive engine how much is the viscosity lowered?—D. J. P.

According to Sparrow & Eisinger in Volume 18, page 482, 1926 of Industrial & Engineering Chemistry, the loss in viscosity is somewhat as follows:

VISCOSITY, UNIVERSAL SAYBOLT SECONDS AT 100° F.

Dilution—	10%	20%	30%	40%
300	168	115	71	44
600	315	178	95	54
1,000	500	250	175	63
4,000	1,450	510	200	83

Inasmuch as thinner oils are now used and the percentage of crankcase dilution now usually does not exceed 15 per cent, the following values were estimated by the use of the A.S.T.M. viscosity blending chart.

VISCOSITY, UNIVERSAL SAYBOLT SECONDS AT 100° F.

Dilution—	5%	10%	15%
100	88	78	70
200	160	130	110
400	300	225	175
600	430	315	230

It was assumed that the dilution oil has a viscosity of 33 seconds Universal Saybolt.

Drifting Exchanger Tubes

What is meant by "drifting" tubes in an exchanger?

Although tubes may be fastened by several methods, the two most common methods today are rolling and drifting. Drifting is resorted to only for very small diameters which cannot be readily rolled. The mechanical difficulties in constructing tube rollers for diameters less than ⅝ in. makes some other method more feasible. Small tubes are usually expanded into the tube sheet by driving a series of ball-headed drift pins into the end of the tube by means of an air hammer. Only a limited expansion of the tubes is possible by drifting and hence the dimensions of the holes and tubes must be exact and careful workmanship is required.

Repressuring Operations in West Texas Pool

by E. H. Short, Jr.

ONE of the most effective and outstanding repressuring operations in West Texas is Gulf Oil Corp.'s project in the North Ward-Estes pool, Ward County. Of particular engineering interest is the fact that the repressuring of this pool has been in existence for approximately 6 years, which is a sufficient period of time to permit evaluation of results.

Referring to Fig. 1 it will be noted that the Gulf project embraces several sections centering approximately 4 miles northeast of Wickett, Tex. While the present large repressuring system involves approximately 1,865 productive acres, the original beginning in December 1939 was on a modest scale and was characterized by the display of considerable engineering wariness. Two test batteries were selected for the purpose of observing very closely the effects of repressuring and extremely accurate data concerning gas volumes, production, and bottom-hole pressures, were recorded and analyzed to determine further steps to be taken.

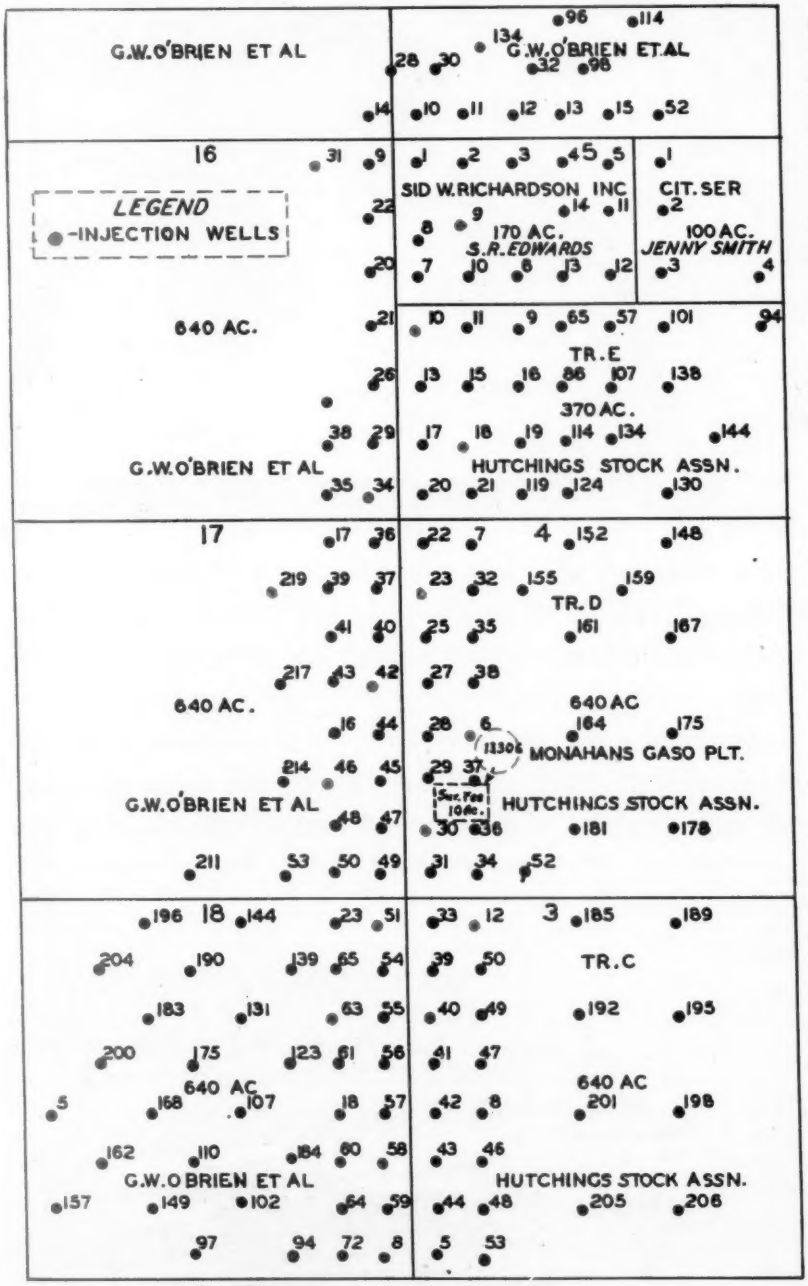

Fig. 1—Project involves approximately 1,865 acres

In the past, sand beds having characteristics of those in the North Ward-Estes pool were ordinarily considered unfavorable to repressuring operations. Such a possibility, although treated with considerable engineering respect, was not wholly accepted as one which would make repressuring impractical, and the results obtained after 5 years of operations indicate that repressuring of lenticular sands can be quite successful through careful engineering planning and supervision.

The main producing zone of the North Ward-Estes pool consists of a number of lenticular sand beds shading off and disappearing to the east, separated by layers of limestone in indefinite patterns. Certain of these lenses of sand and limestone are discontinuous between wells, while other members are fairly continuous over large areas. The beds in the field dip to the west. The average depth of wells in this project was 2,750 ft., with average sand thickness of 60 ft.

In the original repressuring plans for injection wells, therefore, each lens was considered as having its own gas cap at the highest structural point on the lens. Inasmuch as the natural movement of gas through a sand is upstructure (although the fading out of sands in a lenticular structure might contribute toward preventing such movement) key wells were selected well downstructure where good oil saturation might reasonably be expected, and where bypassing and channeling should be at a minimum.

A gas well was drilled on each of the two blocks (O'Brien and Hutchings Stock Association) and gas from each well was used for repressuring the same lease. Gas from the O'Brien well, for example, was used exclusively for repressuring the O'Brien lease.

The first repressuring, or the experimental phase of this project, was begun in June 1940. One Hutchings

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Stock Association and one offsetting O'Brien battery were selected for trial repressuring. Gas was injected into eight key wells by volume-control method, and volumes were gradually increased until at the end of the first 6 months 550,000 cu. ft. per day were being injected into each key well. At that time injection pressures at the well had increased from an average of 227 psi. at the end of the first week in July to 384 lb. at the end of the first 6-month period. Average bottom-hole pressures on the key wells increased from 192 to 350 psi.

During this experimental period a total of 414,744,000 cu. ft. of gas was injected into the eight key wells. The gas from the two gas wells was controlled so that approximately the same amount of gas was injected into the key wells on each block. The results of repressuring during the 6-month experimental period were encouraging. The gains in production rate, as shown by wide-open tests on the wells, amounted to an average of 16.5 bbl. per day per well, or a total of 528 bbl. per day for the 32 wells offsetting the eight key wells. This did not take into account any gains which may have been registered on diagonal or second-row offsets. The increase in bottom-hole pressure on offsetting wells was even more consistent than the test rate increases. All wells in the test area showed an average 24-hour bottom-hole-pressure increase from 176 to 233 psi. at the end of the 6-month period.

The gas-injection rate into the eight original key wells, approximately 4,400,000 cu. ft. per day was reduced at the end of the first 2-year period to approximately 1,600,000 cu. ft. per day. At this time there are 16 key wells and the total daily injection rate amounts to 2,500,000 cu. ft., or 156,000 cu. ft. per well.

The North Ward-Estes repressuring project has increased ultimate recovery since and materially reduced lifting costs. The latter is due to the stabilization of bottom-hole pressures which prolonged the flowing life of many wells. The average bottom-hole-pressure decline has been arrested (as shown in Fig. 2) and in the area immediately surrounding the wells there has been an increase in bottom-hole pressure since the start of repressuring.

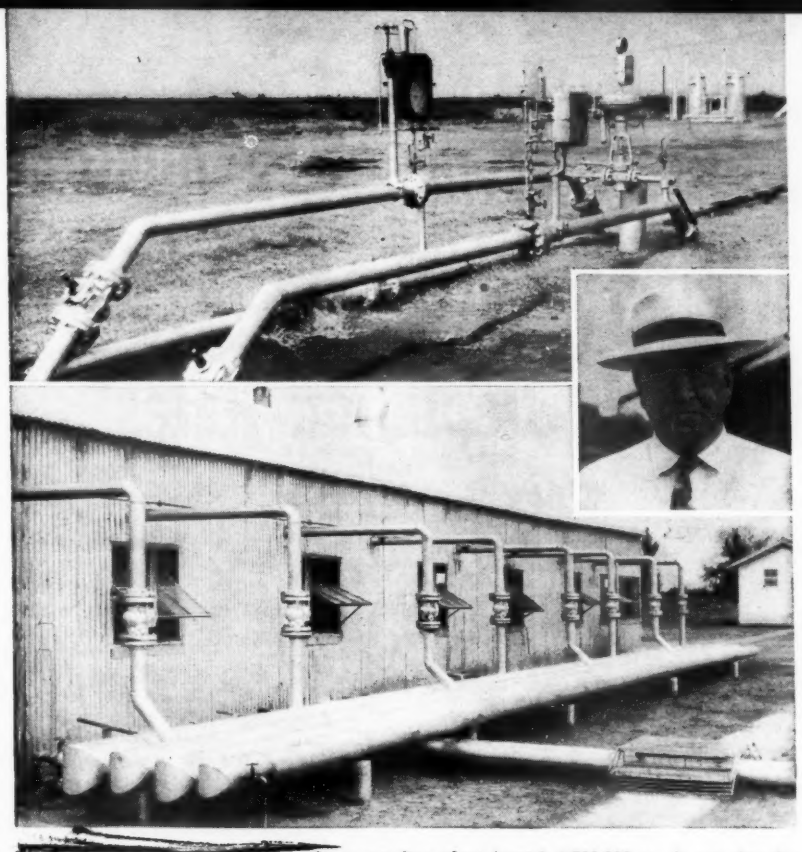

Fig. 3—[illegible] at Monahans gasoline plant furnish 2,700,000 cu. ft. per day for repressuring and about 300,000 cu. ft. for gas lift. These installations measure volume to repressuring and gas lift system. Pressure controller at extreme right holds 290 psi. on gas-lift system

Fig. 4—(Bottom) Four 210-hp. compressor units in one end of Monahans gasoline plant furnish gas for repressuring and also small volume for gas lift. Intake and discharge headers from compressor shown in picture

(Inset) G. A. Peake, in charge of Gulf's West Texas engineering work

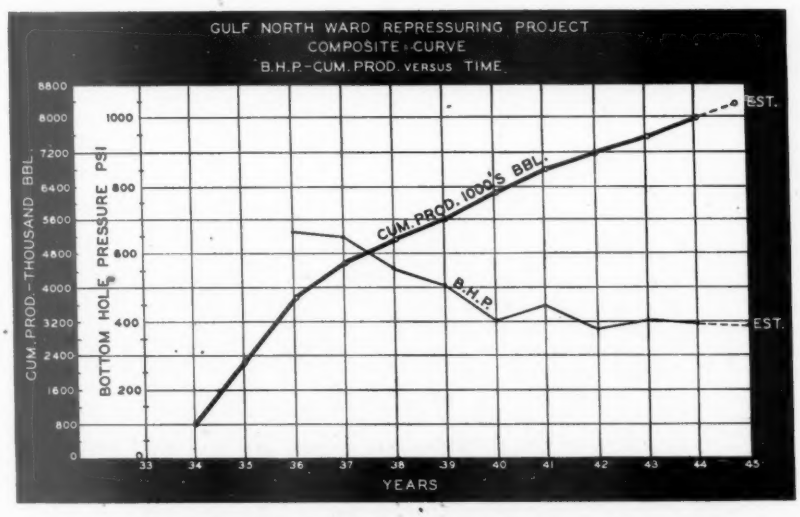

Fig. 2—Composite curve, bottom-hole pressure-cumulative production vs. time

In some areas it is possible that some channeling is taking place; however, as a whole there is sufficient evidence to indicate that this is not widespread. In areas where channeling is suspected, experimental work on producing equipment and individual well-injection rates is done in order to reduce formation gas-oil ratios.

Early in the life of this project it was anticipated that at some future date it would be necessary to resort to the residue gas from the Gulf Oil Corp. Monahans gasoline plant for injection purposes. This would present one of the major problems which would have to be overcome—that of hydrogen sulfide corrosion in the high-pressure residue lines.

During the latter part of 1944 gas to the repressuring system was switched over to the Monahans gasoline plant. At that time four 210-hp. compressors capable of delivering approximately 3,000,000 cu. ft. of gas per day were placed on the residue line. To prevent the anticipated corrosion in the residue line a dehydration unit was placed on the line at the plant. There has been no appreciable corrosion in the residue lines, and freezing has also been practically absent.

Optimum Rate of Production For Uniform Producing and Variable Depletion Rates

THE OPTIMUM RATE OF PRODUCTION

PART 24 OF A SERIES

*by Park J. Jones**

DECLINING rates of production may be accompanied by uniform or variable rates of depletion. A procedure for estimating the optimum rate of production for a reserve, a fraction of which is recoverable before production starts declining and a fraction at uniform rates of depletion, was considered in Part 23 of this series. In the present article, variable rates of depletion are considered. A procedure for estimating optimum rates of production for increasing rates of depletion is illustrated by an example on a natural-gas reservoir having water encroachment and one on a cycling project. A procedure for estimating optimum rates of production for decreasing rates of depletion is illustrated by examples on oil reservoirs having marginal reserves.

The Limiting Optimum Rates of Production

CONSIDER a reserve which is recoverable either at uniform rates of production or at uniform rates of depletion. For these conditions, the curves in Fig. 24-1 give the optimum rate of production. Now, suppose a fraction "a" of a reserve is recoverable before production starts declining and a fraction (1 — a), after production starts declining. Evidently, if the declining rate of production is accompanied by increasing rates of depletion, the optimum rate of production for 100 per cent of the reserve is some value between those defined by the curves in Fig. 24-1.

Optimum for Increasing Rates of Depletion

The rate of production Q corresponding to variable rates of depletion is defined by

$$Q = R\,[1 + (p - 1)\,Rn]^{p/(1-p)}$$

where R is the initial rate of production, n is time and p depends on producing and operating methods. For increasing rates of depletion p is equal to some value between zero and one. As an example, when p equals ½ the rate of production at any time n is defined by

$$Q = R\,(1 - Rn/2)$$

The present value of the production accumulated at the above rate is readily determined relative to the time production starts declining. But, if we were to discount this present value for the time interval during which a fraction "a" of an initial reserve is accumulated before production starts declining, the procedure becomes too involved for practical purposes. In lieu of the exact procedure, we suggest that the optimum rate of production defined by

$$Q_o = Qa + (Q + R)\,(1 - a)/2 \quad (1)$$

is accurate enough for practical purposes. Equation 1 states that the optimum rate of production Q_o is equal to the sum of two factors. The first factor, Qa, is the optimum rate of production Q for uniform rates of production multiplied by the reserve "a" recoverable at uniform rates of production. The second factor, (Q + R) (1 — a)/2, is the average of the optimum rates of production and depletion, (Q + R)/2, multiplied by the reserve (1 — a) recoverable at increasing rates of depletion.

Natural-Gas Reservoirs

Fifty per cent of a trillion-cubic-foot natural gas reserve is recoverable before production starts declining. Because of water encroachment, declining rates of production are accompanied by increasing rates of depletion. Estimate optimum conditions.

Fifty per cent of a trillion-cubic-foot natural gas reserve is recoverable before production starts declining. Because of water encroachment, declining rates of production are accompanied by increasing rates of depletion. Estimate the optimum conditions if (1) the per well investment is 2 billion cubic feet, (2) average per well producing capacity at the time production starts declining is 8 million feet per day, (3) the peak demand during winter months is 20 per cent above the annual average demand, (4) the burden on production is 35 per cent of gross for the first 50 per cent of the reserve, (5) the equivalent operating outgo for the second 50 per cent of the reserve is 45 per cent of gross, and (6) the reserve can be financed at a cost of 3 per cent.

In this example, the ratio X of per well annual producing capacity, relative to peak demand at the time production starts declining, to the per well investment is defined by

$$X = 8\,(365)/1.2\,(2) = 1.217$$

The product X (1 — B) for the first 50 per cent of the reserve is given by

$$X\,(1 - B) = 1.217\,(1 - 0.35) = 0.791$$

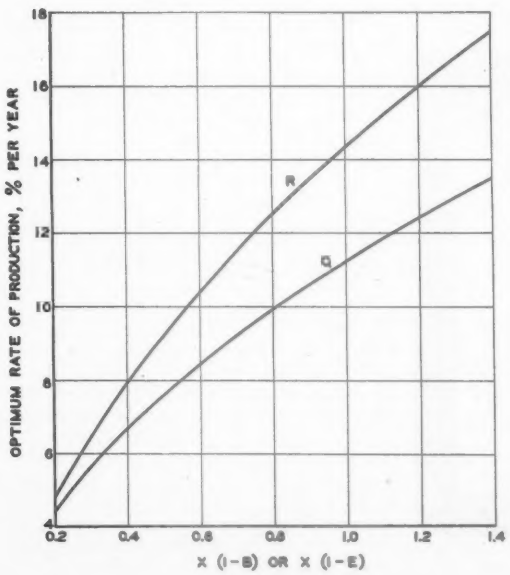

Fig. 24-1—The optimum rate of production Q for uniform rates of production and R for uniform rates of depletion vs. the product X (1 — B) and X (1 — E); X is the ratio of per-well annual producing rate to per-well investment; (1 — B) or (1 — E) is income after operating outgo; interest is 3 per cent

*Production consultant, Houston.

From the Q curve in Fig. 24-1, the optimum rate of production corresponding to 0.791 is 9.9 per cent per year of the trillion-foot reserve. The product X (1 — E) for the second 50 per cent of the reserve is given by

$$X\,(1 - E) = 1.217\,(1 - 0.45) = 0.669$$

From the R curve in Fig. 24-1, the optimum rate of production corresponding to 0.669 is 11.2 per cent and from the Q curve, 9.0 per cent.

By Equation 1, the approximate optimum rate of production is as follows:

$$Q_o = 0.5\,(9.9) + \frac{0.5}{2}\,11.2 + 9.0$$

$$= 10.0 \text{ per cent per year}$$

The optimum conditions may be itemized as follows:

Optimum rate of production, billion per year	100
Optimum rate of production, million per day	274
Optimum number of wells	41
Optimum investment, billion feet	82
Optimum investment, per cent of reserve	8.2

Cycling for Condensate

Forty per cent of a 40-million-barrel condensate reserve is recoverable before production starts declining. By controlling injection rates, declining rates of condensate production will be at increasing rates of depletion. Estimate the optimum conditions if (1) the per producing well investment is 280,000 bbl. of condensate. This investment includes plant, producing well, injection well and field line, investments, (2) the condensate content averages 50 bbl. per million cubic feet of gas, (3) the per well producing capacity averages 500 bbl., or 10 million feet, per day, (4) the burden on production for wells, lines, and plant is 40 per cent of gross for the first 40 per cent of the reserve, (5) the equivalent operating outgo is 50 per cent of gross for 60 per cent of the reserve, and (6) the cost of financing the reserve is 3 per cent.

In this example, the ratio X of per producing well annual capacity to per producing well investment is defined by

$$X = 500\,(365)/280{,}000 = 0.643$$

The product X (1 — B) for the first 40 per cent of the reserve is given by

$$X\,(1 - B) = 0.643\,(1 - 0.4) = 0.386$$

From the Q curve in Fig. 24-1, the optimum rate of production corresponding to 0.386 is 6.5 per cent per year of the 40-million-barrel reserve. The product X (1 — E) for the remaining 60 per cent of the reserve is given by

$$X\,(1 - E) = 0.643\,(1 - 0.5) = 0.321$$

From the R curve in Fig. 24-1, the optimum rate of production corresponding to 0.321 is 6.8 per cent per year and from the Q curve, 5.9 per cent.

By Equation 1, the approximate optimum rate of production is:

$$Q_o = 0.4\,(6.5) + \frac{0.6}{2}\,(5.9 + 6.8)$$

$$= 6.41 \text{ per cent per year}$$

The optimum conditions may now be itemized as follows:

Optimum rate of production, barrels per day	7,000
Optimum rate of production, million feet per day	140
Optimum number of producing wells	14
Optimum investment, million barrels of condensate	3.92
Optimum investment, per cent of condensate reserve	9.8

The foregoing tabulation is relative to the condensate reserve only. The optimum producing rate would be higher relative to condensate and current, or prospective, gas sales.

Decreasing Rates of Depletion

Suppose that a fraction (1 — a) of an initial reserve is recoverable at decreasing rates of depletion. It can be shown that the present value of this fraction is defined by

$$P = \frac{Q\,(1 - a)\,(1 - m)}{Q + i\,(1 - a)}\,(1 - E)\,e^{-1a/Q}$$

where "a" is the fraction of an initial reserve recoverable before production starts declining; E is the equivalent operating outgo for declining rates of production; and m is the fraction of the reserve (1 — a) which is marginal. The exact procedure for estimating optimum rates of production for decreasing rates of depletion is also too involved for practical purposes. In lieu of the exact procedure, we suggest that the optimum rate of production defined by

$$Q_o = Qa + R\,(1 - a)\,(1 - m)^{1/2} \quad (2)$$

is accurate enough for practical purposes. The second factor of Equation 2 contains $(1 - m)^{1/2}$ which shows the effect of marginal reserve on optimum rates of production.

Forty per cent of a 40-million-barrel oil reserve is recoverable at uniform rates of production and 60 per cent at decreasing rates of depletion of which 20 per cent is marginal reserve. Estimate the optimum conditions if (1) the per well investment averages 20,000 bbl., (2) the per well producing capacity at the time production starts declining is 30 bbl. per day, (3) the burden on production is 40 per cent of gross for the first 40 per cent of the reserve, (4) the equivalent operating outgo is 60 per cent of the remaining reserve exclusive of the marginal reserve, and (5) the cost of financing the reserve is 3 per cent.

In this example, the ratio X of per well annual producing capacity at the time production starts declining to the per well investment is defined by

$$X = 30\,(365)/20{,}000 = 0.548$$

The product X (1 — B) for the first 40 per cent of the reserve is given by

$$X\,(1 - B) = 0.548\,(1 - 0.4) = 0.328$$

From the Q curve in Fig. 24-1, the optimum rate of production corresponding to 0.328 is about 6.0 per cent per year of the 40-million-barrel reserve. The product X (1 — E) for the remaining reserve is given by

$$X\,(1 - E) = 0.548\,(1 - 0.6) = 0.219$$

From the R curve in Fig. 24-1, the optimum rate of production corresponding to 0.219 is 5.1 per cent for 60 per cent of the reserve of which 20 per cent is marginal.

By Equation 2, the approximate optimum rate of production is:

$$Q = 0.4\,(6) + (0.8)^{1/2}\,(0.6)\,(5.1)$$

$$= 5.15 \text{ per cent per year}$$

The optimum conditions for this example may now be itemized as:

Optimum rate of production, million barrels per year	2.06
Optimum rate of production, barrels per day	5,600
Optimum number of wells	187
Optimum investment, million barrels	3.74
Optimum investment, per cent of reserve	9.37

Fifty per cent of a 40-million-barrel oil reserve is recoverable before the average per well producing capacity declines down to 80 bbl. per day. Forty per cent of the remaining oil is marginal. Estimate the optimum conditions if (1) the per well investment averages 40,000 bbl., (2) burden on production is 30 per cent of gross for the first 50 per cent of the reserve, (3) the equivalent operating outgo is 50 per cent of the remaining reserve exclusive of the marginal reserve, and (4) the cost of financing the reserve is 3 per cent.

In this example, the ratio X of per well annual producing capacity at the time production starts declining to the per well investment is defined by

$$X = 80\,(365)/40{,}000 = 0.73$$

The product X (1 — B) for the first 50 per cent of the reserve is given by

$$X\,(1 - B) = 0.73\,(1 - 0.3) = 0.511$$

From the Q curve in Fig. 24-1, the optimum rate of production corresponding to 0.511 is 7.7 per cent per year of the initial reserve. The product X (1 — E) for the remaining reserve is given by

$$X\,(1 - E) = 0.73\,(1 - 0.5) = 0.365$$

From the R curve in Fig. 24-1, the optimum rate of production corresponding to 0.365 is 7.4 per cent of the initial reserve.

By Equation 2, the approximate optimum rate of production is as follows:

$$Q = 0.5\,(7.7) + (0.6)^{1/2}\,(0.5)\,(7.4)$$

$$= 5.72 \text{ per cent per year}$$

The optimum conditions for this example may be itemized as follows:

Optimum rate of production, million barrels per year	2.29
Optimum rate of production, barrels per day	6,240
Optimum number of wells	78
Optimum investment, million barrels	3.12
Optimum investment, per cent of reserve	7.8

Application of Laboratory Data on Phase Behavior to Condensate-Reserves Evaluation

by E. W. McAllister

WITH the recognition of the phenomenon of retrograde condensation, the petroleum engineer has been faced with a new problem in estimating petroleum reserves in high-pressure condensate or distillate-type reservoirs. In addition to the reserves in place, it has been necessary to estimate the additional recovery of products to be expected from this type reservoir when produced under a pressure-maintenance or cycling program over that which would be recovered under a normal pressure depletion program. Also, whether or not the increased recovery would economically justify the additional expenditure required for high-pressure equipment and increased operating costs of a cycling program.

While the phenomenon of retrograde condensation has been recognized in laboratory work for many years, there is still considerable lack of the specific information required to properly estimate the petroleum products which would be recovered from the condensate pool produced by straight pressure depletion. This is due to the lack of laboratory equipment suitable for running condensation or phase behavior experiments on samples involving a change in composition with decrease in pressure. This experiment involves withdrawing portions of the sample in the gas phase, causing each increment of pressure decrease and determining the composition of the portions of sample withdrawn and remaining. At present, nearly all laboratories are equipped to run phase-behavior experiments involving no change in composition of the sample and showing only the indicated relative volume of liquid condensed with change in pressure and without determining the composition of the liquid so condensed. This type of data is suitable only for determining the product to be discovered at the dew-point pressure or above, with an indication of the magnitude of the rate of liquid condensation which may occur in the reservoir with pressure drop in the retrograde region.

For example, in Fig. 1 are condensation curves for samples taken from two different condensate fields plotted from data from experiments run involving no change in composition of the samples. These curves are the customary type run in phase-behavior experiments. The scale showing "Liquid Formation Volume—Per Cent" indicates the relative amount of liquid condensed in the apparatus at the corresponding pressure on the basis that the volume of the liquid phase of the sample originally contained in the apparatus at standard conditions was equal to 1 or 100 per cent. By way of explanation, it will be noted that the relative liquid volume as indicated by the curves does not approach 1 or 100 per cent at zero pressure. This is due to the experiments being run at reservoir temperature which in case of the curves in question is considerably above the standard temperature of 60° F. at which the original volume of the liquid samples was determined. As a consequence, lighter fractions originally contained in the liquid samples are vaporized due to the elevated temperatures.

The author is chief engineer of Western Gulf Oil Co. In this article, which was presented at a recent meeting of the California Natural Gasoline Association, at Los Angeles, he discusses condensate reserves which are rapidly becoming an important factor in California and other oil areas.

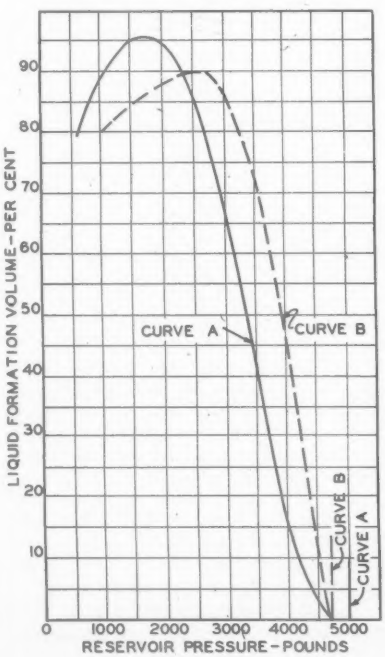

Fig. 1

Determining Dew-Point Pressure

From these curves are determined the dew-point pressure at which condensation starts with the attendant loss of heavier hydrocarbons in the reservoir. Also, indicated by the general shape and slope of the curves in relation to each other are the relative rates of condensation which occur below the dew point; that is, Curve A indicates a less rapid rate of condensation immediately below the dew point than does Curve B.* This coupled with the fact that the dew point of Curve A is approximately 300 psi. below its original reservoir pressure indicates a lower percentage of increased recovery for a pressure-maintenance program than does Curve B.

However, the apparent liquid condensation below the dew point as indicated by both curves is misleading since the volume of the condensed liquid as shown consists in part of lighter hydrocarbons (methane, ethane, etc.), in solution due to pressure and which would not be recovered as a liquid product under atmospheric conditions. Curve A, for example, indicates a liquid condensation, in relation to the original liquid sample, of 16.5 per cent at 4,000 psi. pressure of which only approximately 55 per cent is recoverable liquid. In other words, rather than 16.5 per cent of the original liquid volume condensing at 4,000 psi., representing a possible loss in the formation, only about 9 per cent of the original liquid sample is condensed. It can readily be seen from this comparison that the loss of heavier hydrocarbons by condensation in the reservoir, as determined from curves such as those in Fig. 1, would not be representative of the loss which would occur in actual practice.

*A.I.M.E. Tech. Pub. No. 1861, "Volumetric and Phase Behavior of Oil and Gas Paloma Field," by R. H. Olds, B. H. Sage, and W. N. Lacey.

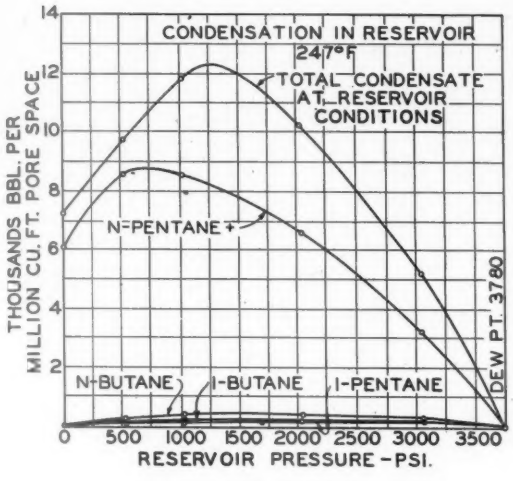

Fig. 2

The possible magnitude of this difference is indicated by the curves in Fig. 2.* These curves are plotted from data from an experiment run on samples from a field other than those sampled for the experiments previously discussed. The curves in Fig. 2 show the condensation of isobutane, normal butane, isopentane, and normal pentane and less volatile fractions with pressure drop in addition to a total condensation curve similar to those in Fig. 1. However, in the case of the experiment for the curves in Fig. 2, the composition of the sample was continually changed by withdrawing a portion of the sample remaining in the gas phase for each decrease in pressure. This is more nearly representative of producing a field by pressure depletion than are the experiments run for obtaining the curves in Fig. 1, in which the composition of the samples were maintained constant and the volumes varied to obtain changes in pressure.

It will be noted in Fig. 2, the isobutane, normal butane, and isopentane fractions are nearly or completely vaporized at zero pressure. Thus, if the reservoir pressure could be completely depleted, there would be very little, if any, loss of these fractions due to condensation within the reservoir and consequently no benefits would be derived from a pressure-maintenance program. In the case of the normal pentane and heavier hydrocarbons, the curve indicates these fractions do not completely vaporize at zero pressure and also the condensation of these fractions reaches a maximum at approximately 600 psi. This pressure is only slightly above the pressure range which is normally used in estimating the pressure remaining in a reservoir at abandonment. The difference between this latter curve and the curve showing total condensation, which includes methane, ethane, etc., will be noted.

The curves in Fig. 3, plotted from data obtained from the same experiments as the curves in Fig. 2, indicate the cumulative barrels of isobutane and heavier, isopentane and heavier, and normal pentane and heavier to be recovered per million cubic feet of pore space as a function of pressure. Assuming no repressuring effect from edgewater, the ordinates of these curves multiplied by the net pore space of the reservoir in millions of cubic feet will give directly the production of each product which can be expected by producing the field by pressure depletion to any reservoir pressure.

The curves in Fig. 4, also plotted from data from the same experiments as the curves in Figs. 2 and 3, show the barrels of each component in the stable condensate per million cubic feet of high pressure separator gas which will be produced at the various reservoir pressures. From these curves the amount of gas which would have to be handled for each barrel of condensate during any period of the life of the field under pressure depletion is indicated. That is, initially approximately 1,000,000

*Figs. 2, 3, and 4, Table 1: Gulf Research & Development Co.

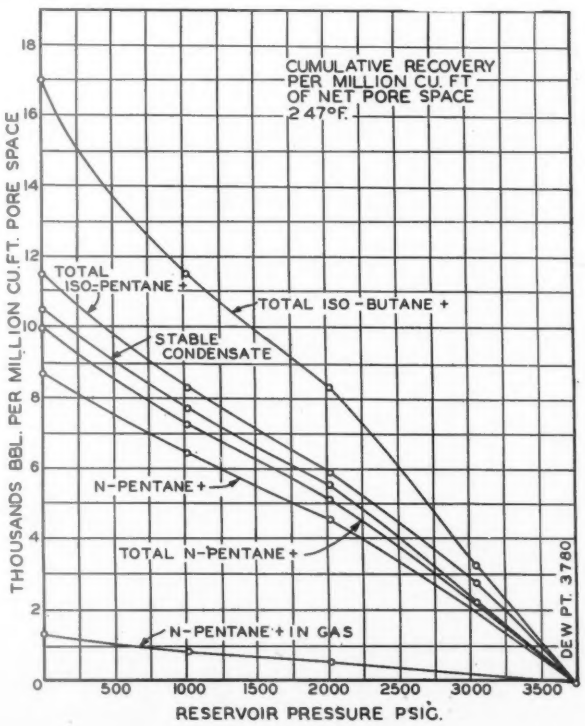
CUMULATIVE RECOVERY PER MILLION CU. FT OF NET PORE SPACE 247°F.
TOTAL ISO-PENTANE +
TOTAL ISO-BUTANE +
STABLE CONDENSATE
N-PENTANE +
TOTAL N-PENTANE +
N-PENTANE + IN GAS
DEW PT. 3780
THOUSANDS BBL. PER MILLION CU. FT. PORE SPACE
RESERVOIR PRESSURE PSIG.

Fig. 3

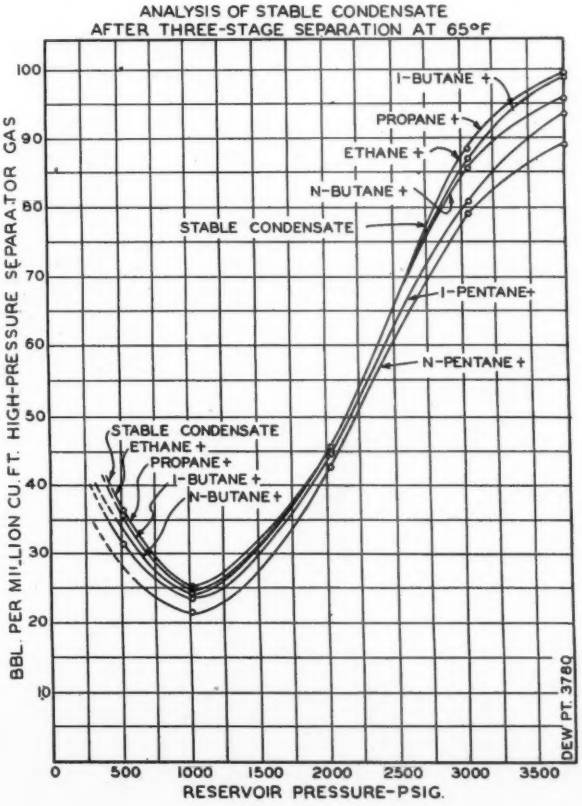

Fig. 4

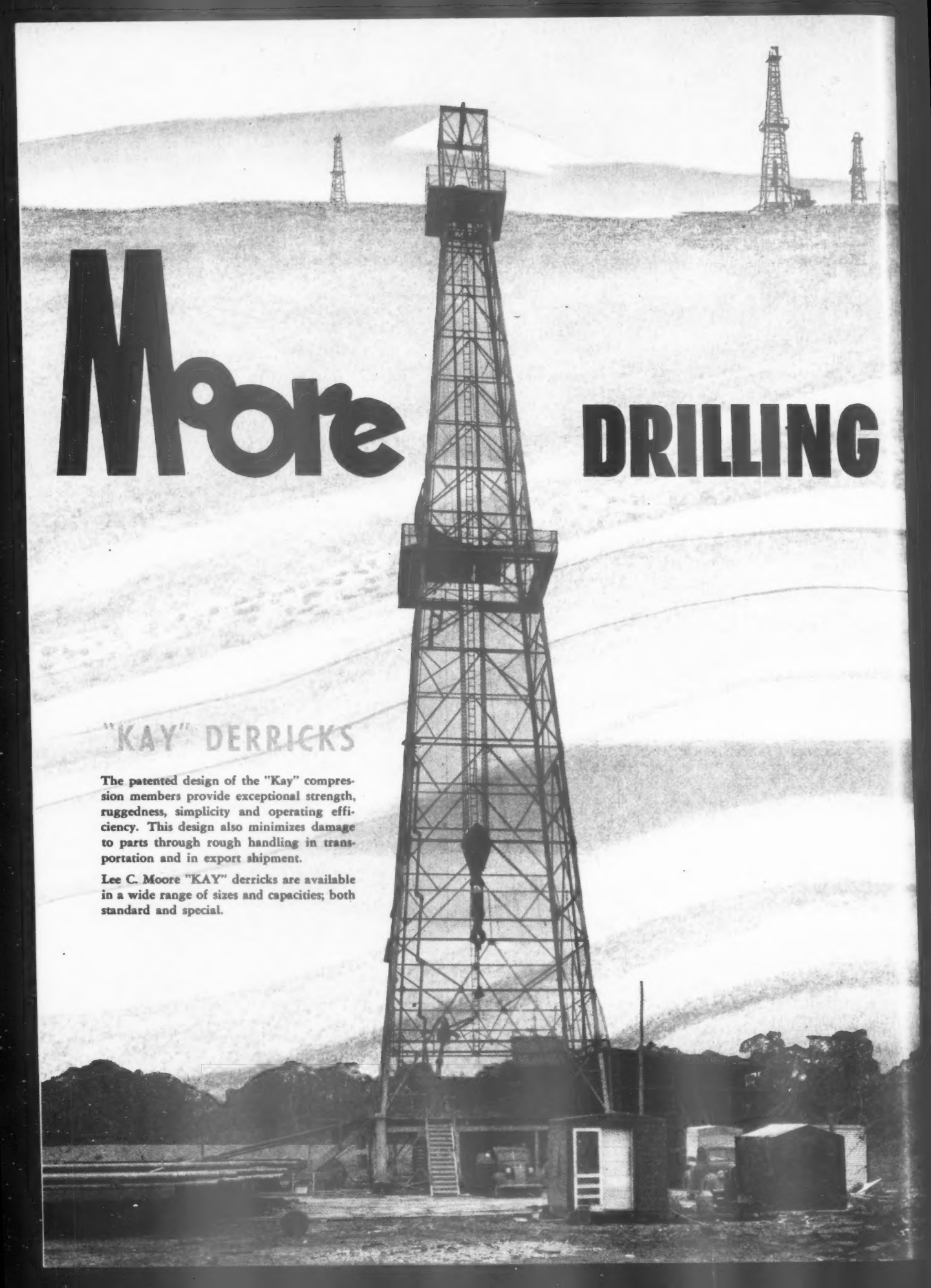
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TABLE 1

Components—	Hydrocarbons originally present in reservoir: Bbl. per M.M.c.f. pore space	Per cent	Hydrocarbons recoverable: Cycling with subsequent pressure depletion to 500 lb.* Bbl. per M.M.c.f. pore space	Per cent	By pressure depletion to 500 lb. Bbl. per M.M.c.f. pore space	Per cent
Isobutane+	23,650	100	19,240	81.4	13,680	57.8
n-Butane+	21,220	100	16,980	80.0	11,380	53.6
Isopentane+	18,710	100	14,850	79.4	9,770	52.2
n-Pentane+	17,490	100	13,710	78.4	8,600	49.2
Condensate†	17,460	100	14,430	82.7	.....	...

*Assuming 70 per cent of the reservoir cycled with a 10 per cent pressure drop during cycling period due to removal of liquid products and gas used as plant fuel. †Unstabilized or raw condensate.

cu. ft. of gas would be handled with each 100 bbl. of stable condensate produced, while at the time when the reservoir pressure has been depleted to 2,000 psi. only 45 bbl. of condensate will be produced with each million cubic feet of gas. In other words, the gas-oil ratio has been more than doubled due to condensation of heavier hydrocarbons within the reservoir because of pressure drop.

The same data as presented in Figs. 2 and 3 are used to determine the volume of the recoverable hydrocarbons which may be expected under a cycling or pressure-maintenance program.

As an example, assume 70 per cent of the reservoir may be cycled and the average reservoir pressure drop during this period, because of the extraction of liquid products and gas used as fuel, will be 10 per cent (400 psi.) resulting in a reservoir pressure of 3,400 psi. From Fig. 2, it is indicated that approximately 1,590 bbl. of normal pentane and heavier hydrocarbons per million cubic feet of pore space will be condensed or lost in the reservoir with this pressure reduction. Based on formation volume factors derived from the experiments, it is calculated 17,490 bbl. per million cubic feet of pore space of pentane and heavier hydrocarbons were originally in place. Deducting the 1,590 bbl. lost by condensation from this figure and multiplying by 70 per cent gives a recovery of 11,130 bbl., from the 70 per cent of the area assumed to be cycled.

In the uncycled portion of the field, which will be produced subsequent to the cycling program by pressure depletion to 500 psi. Fig. 3 indicates a recovery of 8,600 bbl. of normal pentane and heavier hydrocarbons per million cubic feet of pore space, which multiplied by 30 per cent gives a recovery of 2,580 bbl. in the uncycled area. This is equal to a combined recovery from the total area of 13,710 bbl. of normal pentane and heavier hydrocarbons per million cubic feet of pore space or 78.4 per cent of the original hydrocarbons in place. As a matter of comparison under straight pressure depletion program, the recovery would have been 8,600 bbl. or 49.2 per cent of the original hydrocarbons in place. Likewise, as shown in Table 1, the recovery of any hydrocarbon fraction or group of fractions may be calculated.

With these data, and knowing the size of the reservoir, the economics of whether to produce a field by pressure depletion or by cycling may be determined. Certain refinements, which may be made in the calculations to assist in evaluating the respective programs, have not been discussed herein, as they were not deemed essential in explaining the use of the basic data.

Atomic Explosion Leads to New Oil Exploring Methods

NEW YORK.—The first controlled earthquake in the history of seismology—when the atomic bomb was dropped last July in New Mexico—may result in new methods of oil prospecting by charting the earth's structure.

Dr. L. Don Leet, associate professor of geology at Harvard University, said that when the atomic bomb was dropped in New Mexico it provided seismologists with an entirely unexpected shock wave, a wave that may lead to valuable discoveries in seeking oil deposits and mapping bedrock for supporting large structures.

Since 1904 experimental work has been conducted in computing wave patterns to be expected from sharp, vertical impacts on the ground, Dr. Leet said, but the computations were all theoretical. In New Mexico, for the first time, the exact size, time and duration of the impact were known in advance and the recording instruments were set up with precision.

The observations differed considerably from the theoretical predictions. Most of the energy, it was learned, was carried by two wave types—one the coupled wave first observed in 1939, and the other the new hydrodynamic wave, Dr. Leet said.

This knowledge can be applied to the new science of microseism in which small earth shocks are created and measured and thus aid the charting of storms, controlling stresses from explosions or tall buildings and finding oil. Dr. Leet pointed out that the two waves are as fundamental to seismology as atomic structures are to nuclear physics.

Bill in Mississippi Would Reorganize Oil Board

JACKSON.—A bill for introduction in the legislative session which opened last week looks to reorganization of the Mississippi Oil and Gas Board and creation of a technical staff. The bill, sponsored by Sen. Luther A. Whittington, of Natchez, would establish a seven-man oil and gas board with members appointed by the governor for staggered terms. The board now consists of the governor, attorney general, land commissioner and supervisor.

The reconstituted board would be empowered to employ a senior petroleum engineer, geologist, geophysicist, supervisor of field engineering and research and other personnel.

S.A.E.-A.P.I. Engineers Complete 1,454 War Projects

NEW YORK.—Including the marvelous work of the Coordinating Research Council, jointly sponsored by the American Petroleum Institute and the Society of Automotive Engineers, with nearly 3,600 engineers in the two industries, 1,454 war engineering projects were completed during World War II, it has been announced. These projects were handled by committees dealing with aviation and motor fuels and lubricants, tanks and ground vehicles of every kind and their servicing, standards, maintenance and transportation, tractors, under the subdivisions shown below. The tabulated data show the extent and subdivisions of this work, which includes the CRC.

SUMMARY OF S.A.E. WAR ENGINEERING PROJECTS

Briefly:	Aeronautics committees	S.A.E. war engineering board	S.A.E. standards committees	Transportation and maintenance	Tractor committees
Committee membership	368	607	496	481	86
Total projects	726	161	187	47	13
New projects	283	40	61	25	7

Thus, including the technical work of the S.A.E.-A.P.I. Coordinating Research Council, more than 3,572 outstanding engineers of the industry have completed 1,454 technical projects for military and civilian government agencies since 18 months before Pearl Harbor.

No. 5 of a series

Cementrol*

Here are two more cementing problems which Larkin Cementrol Equipment has solved.

At the right is illustrated the manner in which Cementrol may be applied to overcome two distinct cementing problems: (1) protection of the open hole formation immediately below the casing seat and (2) cementing of the casing string above a cavity, crevice or other "zone of lost circulation."

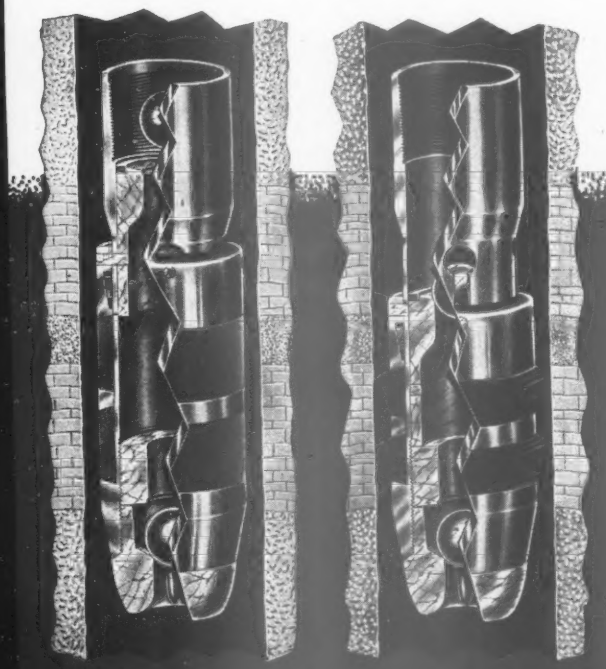
The lower zone is cemented by the displacement method through a Cementrol shoe. A Bakelite bridging ball, small enough to pass through the Cementrol Collar, is pumped down and allowed to rest on the Bakelite sleeve valve of the Cementrol shoe. Pump pressure is applied to expand the packing elements and expose the side cementing ports.

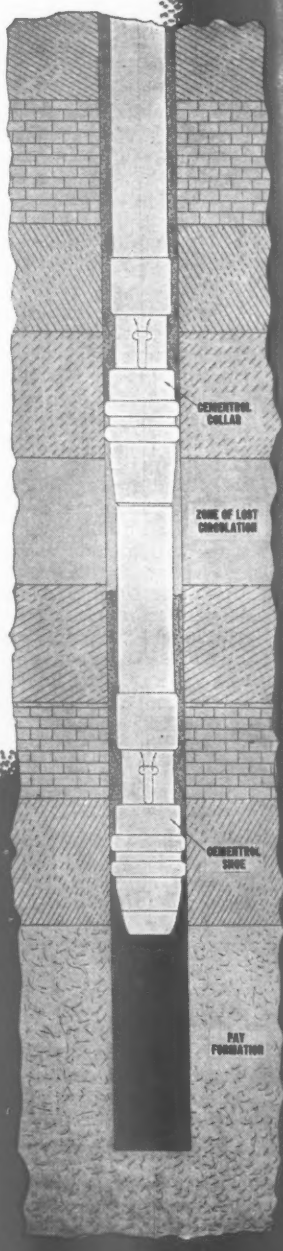
The upper zone is cemented in a similar manner, either by the displacement or plug method. A larger Bakelite ball is dropped in order to expand the packer and expose the side cementing ports.

In the first stages of development, the Cementrol principle of cementing oil wells was considered to be rather limited in its application. However, as the oil world becomes more familiar with this new device, more and more operators are suggesting uses which will solve their specific cementing problems. These new uses are being broadcast to the industry as rapidly as they become perfected.

Full details on the applications and operation of Larkin Cementrol equipment will be gladly furnished upon request. But check with your supply store. They have a complete line of Larkin Equipment.

*Reg. U. S. Pat. Off.





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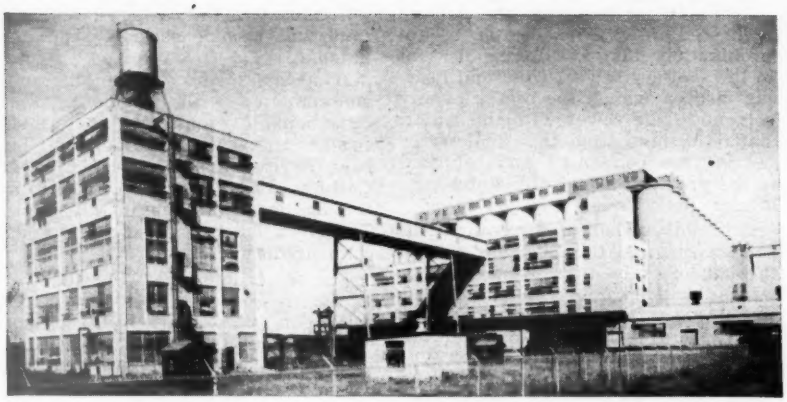


Hexane is used as a solvent in this new soybean-oil-extraction plant of A. E. Staley Manufacturing Co. at Decatur, Ill.

Hexane Used as Solvent For Soybean Oil Extraction

by R. E. Greenfield, Ph. D.

THE new $2,000,000 soybean-oil-extraction plant recently placed in operation by A. E. Staley Manufacturing Co. at Decatur, Ill., uses a hexane-type solvent in one of the many applications of a petroleum product to an industrial operation.

*Technical superintendent, A. E. Staley Manufacturing Co.

The extraction process leaves less than 1 per cent of oil in the soybean meal, as compared with some 4 per cent left by the expeller, or pressing, method. Another benefit is that it results in production of meal which has 44 per cent protein content, 3 per cent more than when the oil is pressed out of the soybeans.

The flaked soybeans are conveyed from the preparation building to the extraction building and dropped into buckets in the fully-enclosed elevator. An engineer watches hexane pouring on to a bucket just filled with flaked soybeans

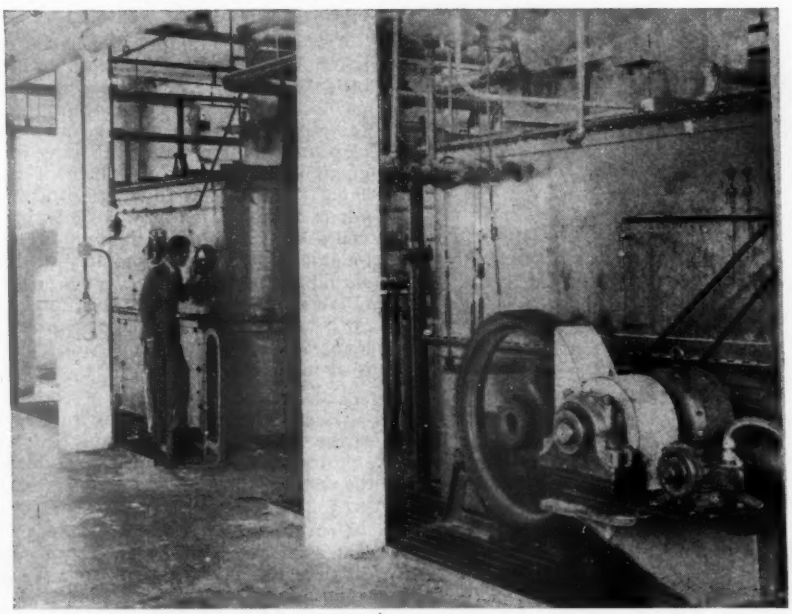


TABLE 1—TYPICAL ANALYSIS OF HEXANE SOLVENT FOR SOYBEAN OIL EXTRACTION

Distillation, A.S.T.M.:	°F.
Init. boil. point	146
5 per cent evap.	148
10	148
20	148
30	149
40	149
50	150
60	150
70	150
80	151
90	152
95	154
End point	156
Recovery, per cent	98
Loss, per cent	2
Residue	None
Gravity, spec.	0.6849
Gravity, A.P.I.	75.1
Doctor test	Neg.
Corrosion	None
Color, Saybolt	30+
Barometric pressure	29.08
Reid vapor pressure, lb.	5

In the solvent extraction method the beans are first cleaned and cracked to suitable sizes, then the bean particles are flaked to allow suitable contact with the solvent in the extraction tower.

The extraction tower, furnished by French Oil Mill Machinery Co., is a large, vertical steel tank in which operates a large vertical bucket elevator. The buckets are baskets with perforated bottoms. They are loaded with raw flakes at the top of the tower, and through the operation of the elevator carried down one side of the tower and up the other.

During this travel fresh solvent poured into the top basket on the upgoing side trickles down from basket to basket until it reaches the bottom. The solvent reaching the bottom on this side (containing about 10 per cent soybean oil) is called half miscella. It is pumped to the top basket on the downcoming side which has just recently been charged with raw flakes. From this basket the solvent-oil mixture again trickles from basket to basket until it again reaches the bottom of the tower. By the time the solvent has reached the base of the tower it contains 20 per cent oil, and is usually called full miscella.

It is removed from the tower, filtered to remove fine particles, and passed through an evaporating system for recovery of solvent for reuse and recovery of oil as one of the products.

The solvent used in this process has an A.S.T.M. distillation range of from 146 to a dry point of 156. The flash point by the tag closed cup method is —30° F. The solvent in the extraction tower is maintained at about 130° F. The tower is vented through a solvent vapor recovery system so that any vapor that tends to escape from the tower is condensed and returned to the system.

The oil solvent recovery system consists, first, of four atmospheric evaporators which are operated in series. A major portion of the sol-

vent is evaporated from the miscella in these atmospheric evaporators. The partially concentrated solvent oil mixture, now containing approximately 40 per cent oil, is then run through a vacuum stripping tower.

The first stage of this vacuum tower is at about 11 in. vacuum; the last stage at a high vacuum is 21-22 in.; and at this stage, in addition to transferring heat to the oil through surfaces which are heated with steam, there is blown through the oil a certain amount of sparging steam or blowing steam to drive out the last traces of solvent.

Water vapor and solvent distilling from these distillation units is condensed in condensers and returned to the system. All condenser solvent passes through a water-separation tank where any water that the solvent may contain settles to the bottom of the tank, and the dry solvent is drawn from the top. Solvent in this condition is suitable for reuse.

Water separated from the solvent is heated in a water heater to approximately 190° F. before it is sent to the sanitary sewer. This final heating insures against the escape of any solvent to the sewer with the water. Vapors coming from this final water heating are condensed and returned to the process through the water separation tank.

All solvent-handling equipment, condensers, and the like, are vented through a solvent-recovery system which includes both condensers and carbon absorption. The condensers on the vacuum stripping tower and the solvent recovery system must be furnished with water at least as cool as 58° F. at all times. This necessitates refrigeration of the surface water supply during the summer months.

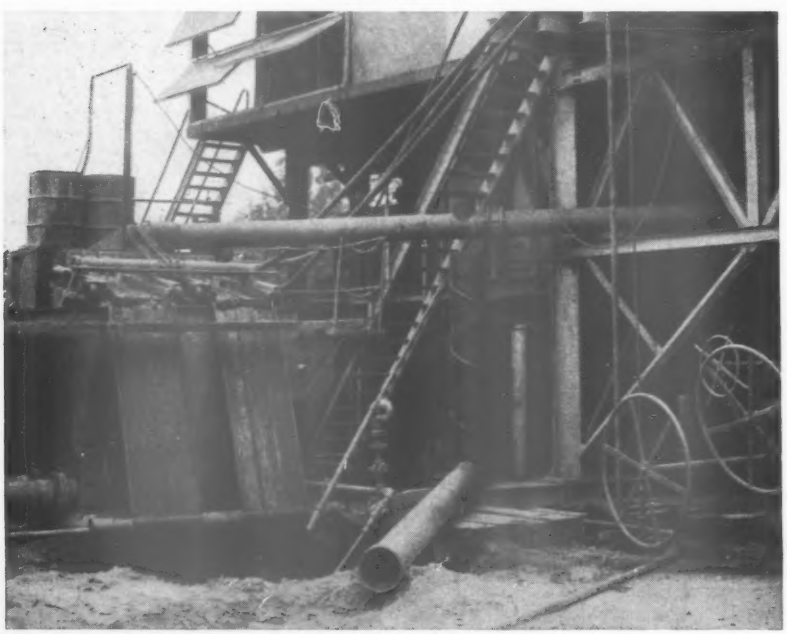
Solvent losses are kept below 0.7 per cent of the weight of the beans processed. This works out to be about 1 gal. of solvent to every 13 bu. of beans processed.

Contaminated Mud Dumped Before It Reaches Shale Shaker and Pit

THERE are times during the drilling of any well when the mud in the hole may become contaminated with objectionable materials which would be impossible or difficult to separate or treat out of the system, and thus make the mud unfit for further use. Should this mud reach the shale shaker and pit it might ruin a pit of mud. This would necessitate cleaning the pit and replacing all the mud in the system, which would involve not only increased mud costs but also substantial delays in drilling.

One such time would be when cementing casing. Especially, if a casing string is being cemented to the surface there is the likelihood of large quantities of cement channeling to the surface before the job is completed, or otherwise getting into the return mud flow. Also, when drilling out cement in the casing or hole, the mud will become seriously contaminated.

A special means of dumping mud contaminated with cement or other objectionable materials before it reaches the shale shaker and pit has been devised and is in use by Lyle Cashion, Ltd., on rigs operated by this drilling contractor in Mississippi. The arrangement is shown in the accompanying picture.



The mud flow line from the well to the shale shaker receiving box is a 10¾-in. pipe. This has a quick-closing flapper gate in the outlet end. In the top of the line, in this case near the midpoint, there is a 10-in. circular opening. This is fitted with a short riser, welded in place, which prevents the mud flow in normal circulation from overflowing and slopping out.

A section of 13⅜-in. pipe is set up vertically directly under the opening so that when the flow line is rotated a half turn and the opening is on the under side the mud flow will dump into it. At the same time by closing the flapper gate in the end of the flow line the mud will be prevented from emptying through the shale shaker into the pit.

The bottom end of the vertical pipe is capped with a metal plate welded on the end. A side outlet is provided at the bottom with a discharge line leading away from the rig to a ditch which carries the contaminated mud to refuse pit. There is a water jet in the bottom of the vertical standpipe with a connection from the rig high-pressure water system to force the mud out the discharge line and down the ditch. This prevents any possibility of contaminating materials settling out in the bottom of standpipe, clogging up the outlet, and thus filling up and overflowing around the rig.

The vertical standpipe was cut from a joint of spiral-welded casing but any other type of pipe would serve the purpose. The length is such that when the unit is set up the top will be close under the opening, allowing just enough interval for clearance of the short riser on the flow line opening when it is turned down. This prevents any splashing of the mud on the outside of the standpipe. In this installation, the flow line is at a height of about 10 ft. so with the unit set on a base about 12 in. above ground level, the length of the vertical pipe is about 8 ft.

Eben Magoffin, Jr., has returned to the Carter Oil Co. as gravity-meter engineer following his discharge from the Marine Corps.

George G. Hughes, Jr., has become senior engineer of the Interstate Oil Pipeline Co. following his separation as an Army major.

Diisopropyl

(Continued from page 73)

to consist of roughly equal amounts of 2,3 and 2,4-dimethylpentanes and minor amounts of other isomers. The octane fraction contained 2,2,4-trimethylpentane as the chief component.

Also shown in Fig. 2 by the dashed line is a fractionation curve of another alkylate made with an excessively active catalyst. Isopentane was present in large amount, and the isohexanes fraction containing the diisopropyl is relatively small. Furthermore, the diisopropyl content of this fraction was below 50 per cent, methylpentanes being the major components.

Commercial operation. — A simplified flow diagram for the commercial plant is shown in Fig. 3. Fig. 4 is a photograph of the alkylation reactor area showing the four reactors and some of the control instruments. Fig. 5 is a general view of the reactor area. An ethane-propane mixture is subjected to low-pressure cracking to produce a near maximum per pass conversion into ethylene. The cracked gas is compressed, freed from liquid hydrocarbons and C_4's, by oil absorption, and is then contacted with cold isobutane to absorb the ethylene and propylene. This, with supplementary isobutane, constitutes the conversion stock which passes to the alkylation plant proper, in which alkylation takes place in the presence of aluminum chloride - hydrocarbon complex catalyst. The temperature of the reactor is controlled by recirculating a portion of the hydrocarbon from the reactor through a cooling coil. Fractionation of the hydrocarbon effluent provides isobutane for recycle and an aviation fuel range alkylate consisting mainly of diisopropyl. A minor part of the alkylate (mainly heptanes) results from propylene which accompanies the ethylene supplied to alkylation.

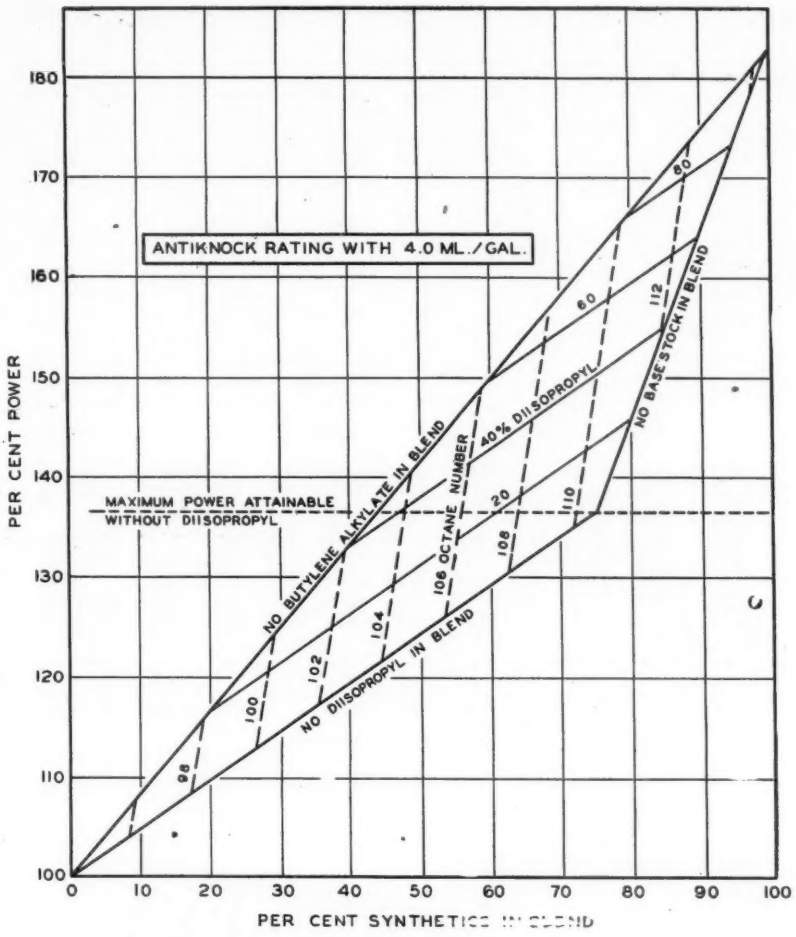


Fig. 6—Antiknock characteristics of blends containing diisopropyl

Diisopropyl in Aviation Fuel

Pure diisopropyl.—Diisopropyl concentrates containing upwards of about 93 per cent of diisopropyl are readily obtained by fractionation of diisopropyl alkylates. The high antiknock properties of such concentrates combined with their relatively low vapor pressure and excellent volatility

TABLE 2—ANTIKNOCK BLENDING CHARACTERISTICS OF PURE DIISOPROPYL

Composition (%)						Evap. temperature, °F. (corrected to 29.92-in. Hg.)								
Pure diisopropyl	Reference fuel blends: 83% S,* 17% M†	93% S,* 7% M†	Aviation base stock No. 1	Reid vapor pressure	A.P.I. gravity	I.B.P.	10%	50%	90%	E.P.	A.S.T.M. aviation Oct. No. with 4 ml. TEL/gal.	Supercharged rating with 4 ml. TEL/gal., % power	Calc. A.S.T.M. aviation blending Oct. No. of diisopropyl with 4 ml. TEL/gal.	Calc. supercharged blending value of diisopropyl with 4 ml. TEL/gal., % power
100	...	...	...	7.35	80.7	134	135	135	136	‡136	113.2	....	....	....
...	100	...	...	1.95	69.8	194	205	213	238	371	104.1	101.1	...	....
...	...	100	...	1.90	71.1	199	207	210	218	339	111.8	122.6	....	....
...	...	...	100	6.75	70.4	119	142	165	198	‡217	94.5	100.0	....	....
10	90	...	...	2.75	70.9	176	193	208	238	368	105.4	108.4	117.1	174.2
30	70	...	...	3.65	73.0	156	171	193	226	353	108.2	124.5	117.8	179.1
50	50	...	...	4.95	75.0	145	157	175	222	343	110.3	141.5	116.5	181.9
...	...	...	...	...	...	...	...	...	...	...	Weighted average		117.0	180.1
10	...	90	...	2.50	72.3	180	194	206	217	339	112.0	130.9	113.8	205.8
20	...	80	...	3.15	73.1	166	182	199	215	331	112.2	139.8	113.8	208.4
40	...	60	...	4.25	75.1	150	164	183	215	311	112.2	152.0	112.8	196.0
...	...	...	...	...	...	...	...	...	...	...	Weighted average		113.2	200.9
10	...	...	90	6.75	71.5	120	140	161	193	‡212	96.5	106.4	114.5	164.3
30	...	...	70	6.85	73.3	125	141	155	188	‡215	100.3	119.1	113.8	163.5
50	...	...	50	6.90	75.4	128	139	148	178	‡207	103.0	134.8	111.5	169.6
...	...	...	...	...	...	...	...	...	...	...	Weighted average		112.6	167.0
...	...	...	...	...	...	...	...	...	...	...	Over-all average		114.3	182.7

*Secondary reference fuel for 2,2,4-trimethylpentane. †Secondary reference fuel for normal heptane. ‡Dry point.

TABLE 3—VOLATILITY AND ANTIKNOCK BLENDING CHARACTERISTICS OF DIISOPROPYL ALKYLATE*

Composition (%)				Evap. temperature, °F. (corrected to 29.92-in. Hg.)								
Aviation base No. 2	Diisopropyl alkylate*	Reid vapor pressure	A.P.I. gravity	I.B.P.	10%	50%	90%	E.P.	A.S.T.M. aviation Oct. No. with 4.6 ml. TEL/gal.	Supercharged rating with 4.6 ml. TEL/gal., % power	Calc. A.S.T.M. aviation blending Oct. No. of alkylate with 4.6 ml. TEL/gal.	Calc. supercharged blending value of alkylate with 4.6 ml. TEL/gal., % power
100	...	6.70	70.7	117	143	165	198	217	95.5	103.2	....	....
...	100	6.75	79.0	136	139	144	169	214	....	....	....	....
90	10	6.70	71.6	122	142	163	199	218	97.3	108.7	113.5	157.5
70	30	6.75	73.2	122	141	157	195	215	100.7	118.1	112.8	152.6
50	50	6.70	74.8	124	142	154	190	216	104.5	134.9	113.5	166.5
...	...	...	...	...	...	...	...	...	....	Weighted average	113.3	160.9

*80.5 per cent diisopropyl.

makes this product a "natural" for blending in the higher quality aviation gasolines.

The antiknock properties of a diisopropyl cut containing 99 per cent of diisopropyl both alone and when blended with several base stocks are shown in Table 2. The base stocks employed were two mixtures of S reference fuel (technical isooctane) with M reference fuel (very low-octane-number Michigan naphtha) and an aviation-base gasoline prepared from Texas Panhandle natural and straightrun gasoline by "superfractionation."

The antiknock properties were determined both by means of the A.S.T.M. "aviation" method (A.S.T.M. D-614) which affords an indication of the power available under normal airplane cruising conditions, and by a "supercharged" method designed to predict the potential performance of an aviation gasoline or component during takeoff or other occasions when peak power is required.

Blending ratings obtained by the A.S.T.M. aviation method are expressed in terms of octane numbers. Octane numbers above 100 were assigned in accordance with a slight modification of the octane number extension scale proposed by Trimble and Richardson.[5]

Supercharged rich-mixture ratings are expressed as the percentage of power obtained in a C.F.R. supercharged engine, assuming 100 per cent power for S reference fuel (technical isooctane). The supercharged rich-mixture rating of diisopropyl is so high that the straight material cannot be satisfactorily tested. For this reason only blending values are shown in the table.

The blending antiknock values for diisopropyl were calculated from the data shown in Table 2 by assuming that the difference between the base blend and the diisopropyl-containing blend resulted entirely from the addition of the specified percentage of diisopropyl. Weighted average blending values for each series of blends were determined by assigning a weight of 1 to 10 per cent blends, 3 to the 30 per cent blends, and 5 for the 50 per cent blends. The over-all average is the arithmetic average of the weighted averages of the several blends.

The data of Table 2 show that some variation in the antiknock values for diisopropyl may be expected depending both on the antiknock level and the type of material to which it is added. With 4.0 ml. TEL diisopropyl had an A.S.T.M. aviation rating of 113.2 octane number while its weighted blending value (plus 4.0 ml. TEL) varied from 117.0 to 112.6 with an average value of 114.3.

The supercharged rich-mixture blending rating of diisopropyl, with

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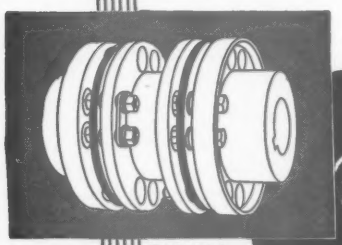

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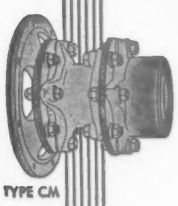

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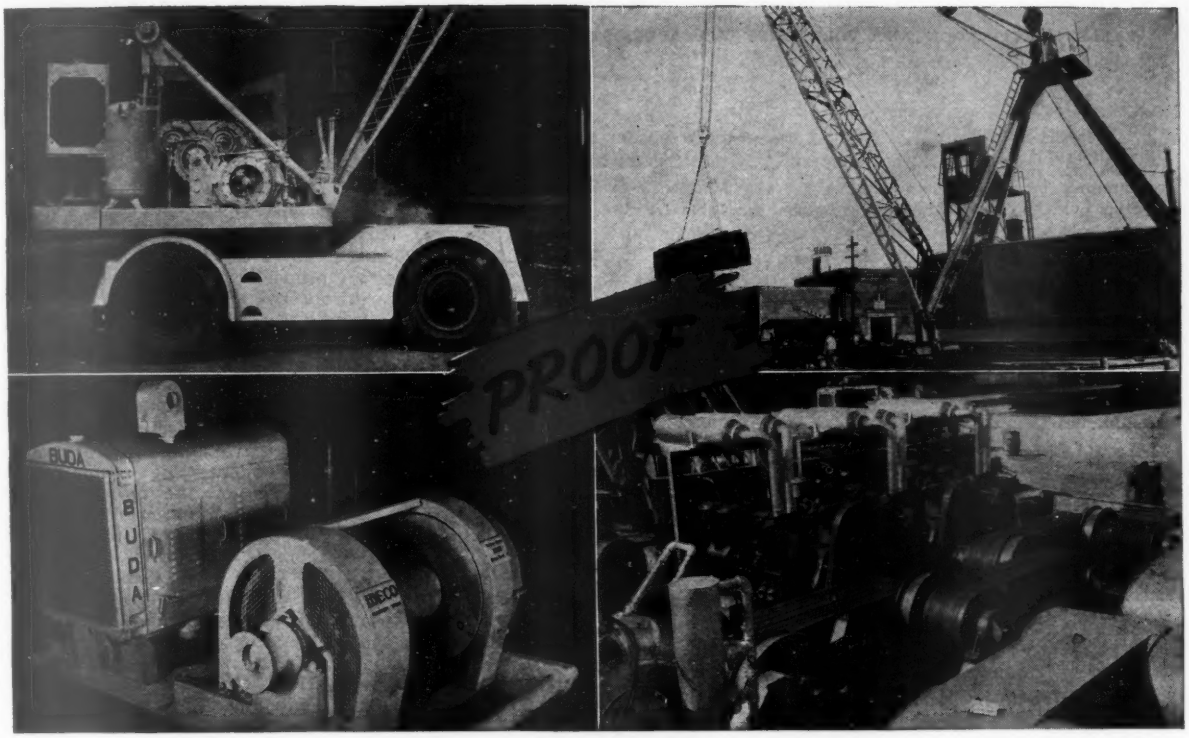

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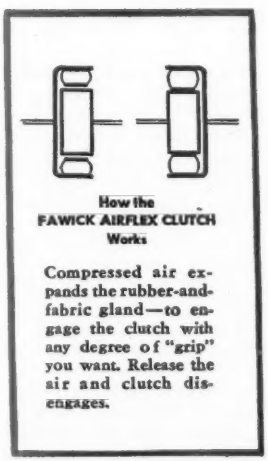

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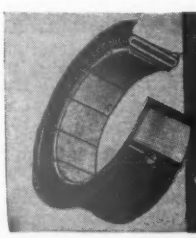

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TABLE 4—ANTIKNOCK AND VOLATILITY CHARACTERISTICS OF PURE DIISOPROPYL AND STOCKS SHOWN IN FIG. 6

Description—	Reid vapor pressure	A.P.I. gravity	Evap. temperature, °F. (corrected to 29.92-in. Hg.) I.B.P.	10%	50%	90%	E.P.	A.S.T.M. aviation Oct. No. with 4 ml. TEL/gal.	Supercharged rich mixture rating with 4 ml. TEL/gal., % power
Pure diisopropyl	7.35	80.7	134	135	135	136	*136	†114.3	†182.7
Aviation-base stock	6.75	70.4	119	142	165	198	*217	94.5	100.0
Isopentanized butenes alkylate	6.80	74.2	104	144	214	232	342	110.6	136.5

*Dry point. †Calculated blending values: see Table 1.

4.0 ml. TEL, varied from 200.9 to 167.0 per cent of the power obtained with S reference fuel, the average value being 182.7. The rich rating superiority of diisopropyl over S reference fuel is well demonstrated by the following tabulation:

	Per cent power
S reference fuel (technical isooctane)	100.0
S reference fuel +1.25 ml. TEL	120.4
S reference fuel +4.0 ml. TEL	145.1
S reference fuel +6.0 ml. TEL	152.1
Diisopropyl (99.0%) +4.0 ml. TEL	182.7

Diisopropyl alkylate.—In Table 3 are shown the inspection and blending properties of a Phillips plant light diisopropyl alkylate when blended in a base stock derived from Texas Panhandle straightrun and natural gasoline.

The commercial diisopropyl aviation alkylate was obtained by topping the total isobutane-ethylene alkylate to separate C_5 and lighter products, and subsequently debutanizing this fraction. It had the following composition: isopentane 0.4 volume per cent, diisopropyyl 80.5, other hexanes 3.0, heptanes 8.4, octanes 4.0, heaviers 3.7.

The weighted average A.S.T.M. aviation and supercharged rich-mixture blending value of this particular alkylate with 4.6 ml. TEL/gal. was 113.3-octane number and 160.9 per cent power. These values are characteristic of alkylate produced from feed stocks containing but little propylene. The values decrease somewhat as the propylene in the feed is increased.

It is apparent from the data of Table 3 that while much of the antiknock rating of the alkylate is due to diisopropyl, the other components present are well above marginal quality.

Blending value of diisopropyl.—Diisopropyl is one of a very limited group of hydrocarbons which combine a very high antiknock rating with almost optimum volatility characteristics. The Reid vapor pressure of diisopropyl is only slightly more than 7 lb. Its boiling point is 136.4° F. Hence, it can be blended into an aviation gasoline with little or no disturbance of Reid vapor pressure and the somewhat low boiling point can be used to offset the too-high boiling points of other high-quality blending agents. The over-all volatility of an average aviation-gasoline blend is increased upon the addition of diisopropyl, and within limits, this results in more uniform distribution of fuel to the cylinders of aircraft engines with resulting improved performance.

Fig. 6 has been prepared to illustrate the antiknock blending characteristics of pure diisopropyl. As has been mentioned previously, fractions containing high concentrations of diisopropyl are comparatively easy of production if removal of the high-quality side products is desired for attainment of the highest antiknock ratings.

The volatility and antiknock characteristics of the stocks employed in Fig. 6 are shown in Table 4. The avia-

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tion-base stock was a mixture of isopentane, "isohexanes" and "isoheptanes," derived from Texas Panhandle straightrun and natural gasoline. The butenes alkylate was isopentanized to approximately 7 lb. vapor pressure.

The ordinates of Fig. 6 are the supercharged rich-mixture rating with 4.0 ml. TEL, as defined earlier, and the volume per cent of synthetic material in the blending formula. The former qualitatively evaluates the rich-mixture performance of the blend while the latter is an approximation of cost on the premise that synthetic components entail a higher manufacturing cost than do the nonsynthetic ingredients.

The top, bottom, and side lines of the triangular diagram in Fig. 6 represent respectively the omission of butylene alkylate, diisopropyl, and aviation-base stock from the blending formulas. Inside the triangle a family of lines approximately parallel to the lower boundary of the triangle represent the effect of the indicated volume percentages of diisopropyl in the blending formula. Another family of curves in the triangle show the A.S.T.M. aviation octane numbers for the various combinations. The dashed horizontal line passing through the juncture of the lower boundaries represents the maximum rich rating attainable without the use of diisopropyl.

Passing horizontally through the triangular graph, that is at any desired rich-mixture rating, it is to be noted that increasing proportions of diisopropyl greatly decrease the proportion of synthetic components that may be used, which in turn decreases the aviation A.S.T.M. octane numbers, as is illustrated by the following tabulation:

Rich mixture rating of blends	With diisopropyl only		With butylene alkylate only	
	Synthetic %	A.S.T.M. aviation Oct. No.	Synthetic %	A.S.T.M. aviation Oct. No.
130	36	101.7	62	107.7
145	54	105.1	80	111.0
160	72	108.7	88	112.4

Passing vertically through the triangular graph, that is, at any desired proportion of synthetic materials, it is to be noted that the rich mixture rating increases rapidly and the A.S.T.M. aviation rating is practically constant with increasing proportions of diisopropyl as is illustrated in the following tabulation:

Per cent synthetics in blend	With diisopropyl		With butylene alkylate only	
	Rich rating	A.S.T.M. aviation Oct. No.	Rich rating	A.S.T.M. aviation Oct. No.
75	163.0	109.2	136.5	110.6
60	150.0	106.4	129.0	107.4
45	136.5	103.1	122.0	104.0
30	125.0	100.2	114.5	100.8

The relationships illustrated in Fig. 6 can readily be revised to evaluate diisopropyl with any combination of aviation-base stock and high octane blending agent. Likewise volatility and other factors can be included on the diagram.

Now that the pressure to produce maximum volume of aviation gasoline is over quality will again become of paramount importance. Diisopropyl offers one means to higher-quality aviation gasoline.

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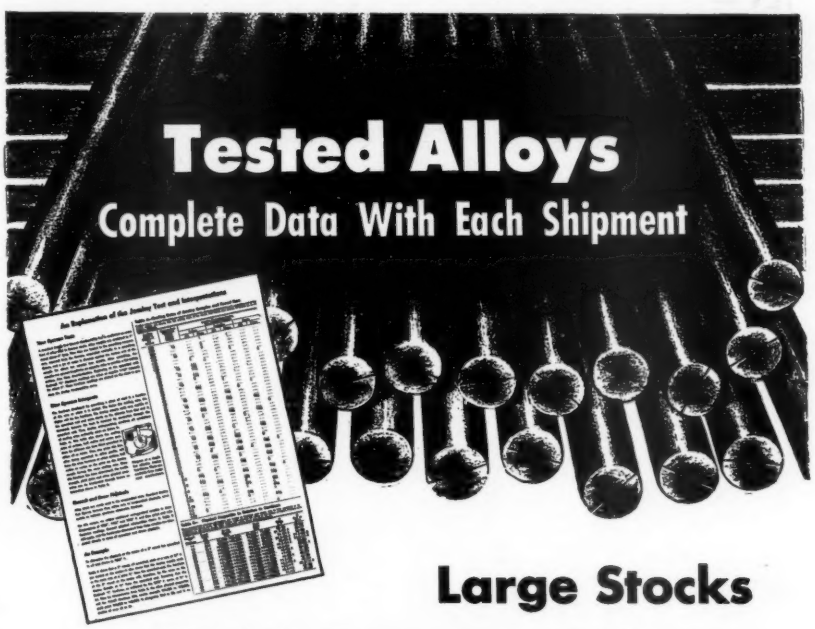
R. R. O'Neil and **Ben H. Bland** have returned to the West Texas division scouting department of Shell Oil Co., Inc., following their release from the Army.

Russell C. Curtis, who was a first lieutenant in the Army Air Corps before his recent release, has returned to the Carter Oil Co. as engineer in the Tulsa office.



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This interesting volume reviews the efforts of mankind to overcome the forces of friction, from the time prehistoric man discovered that it was easier to roll a log than to drag it along the ground, to the present highly developed mechanisms and lubricants. The first chapter considers the petroleum industry and the chemistry of petroleum—world supply, origin, nature, and the science and economics of refining. Drawings are used to illustrate the various points. Chapter 2 takes up the refining and testing of petroleum fuels, refining of fuels, measuring fuel performance, and testing of fuels. The third chapter is devoted to the refining and testing of lubricants, the fourth of the fundamentals of lubrication and lubricant requirements, the fifth to application problems, and answers, the sixth to the story of centralized lubrication, and the seventh to the objectives of purchasing and the functions of selling.

ROPE CHOKERS. By C. K. Stillwagon. Available from the Rein Co., P.O. Box 7598, Houston. 228 pp. $3.

This volume gives the reader an inside look at the human side of the oil industry from the days when it was more of a prospecting game than a known quantity of industry. The author, owner and general manager of Well Equipment Manufacturing Corp., Houston, wrote the book as a means of relaxation in spare time. He takes the reader right on the job and relives for him those rugged days when the cable-tool driller and the rotary driller had the same love for each other that the cattle man and the sheep man shared when pioneer ranch life broiled with words, ropes, and guns. The story is as full of vital statistics and history of the industry as it is of laughs from anecdotes about life as it existed in the early days.

OUR OIL RESOURCES. Edited by L. M. Fanning. McGraw-Hill Book Co., New York. 331 pp. $4.

This is an exhaustive, authoritative study of our oil resources, in terms of geographical knowledge, as well as human resources—engineering and scientific learning, and private initiative and incentive. It is a symposium by a number of authorities on the subject, and supplies a complete accounting of oil up to the present time, with a timely appeal as it assumes increasing significance in international relationships. The book demonstrates the indispensable role of petroleum in our daily life—traces the part of private enterprise in the development of U. S. oil resources, analyzes vital considerations such as conservation, the role of technology, oil, natural gas, coal and shale reserves, oil in public domain, naval reserves, capital employed in the petroleum and American oil industries, and discusses the subject of American oil companies in foreign oil operations. Eighteen authorities and oil-company executives have contributed to this symposium.

ATOMIC ENERGY IN WAR AND PEACE. By Gessner G. Hawley and S. W. Leifson. Published by Reinhold Publishing Corp., 330 West 42nd Street., New York. 211 pp. $2.50.

The first portion of this volume is devoted to the atom, neutrons, energy transformations, combustion, explosions, radioactivity, nuclear fission, and other subjects of fundamental importance. The second portion, based on the official war department report of the atomic bomb project, gives the complete story of this phenominal piece of work and the means used to surmount the obstacles to success that surrounded it. A concluding section discusses future military and industrial applications of atomic energy in the light of present knowledge. The entire account is stripped of unnecessary detail and is concentrated on the main object—to explain the nature and uses of this revolutionary new force. The authors are, respectively, chief technical editor of Reinhold Publishing Co., and head of the physics department of University of Nevada.

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Mollier Diagram for Hydrocarbons

COMPUTATIONS involving entropy and enthalpy may be performed quickly with the aid of a very practical device termed the Mollier Diagram. The usual diagram for hydrocarbon materials is charted according to the accompanying diagram for a typical propane. Similar charts for steam, ammonia, and other vapors are usually constructed with enthalpy and entropy as ordinates but for hydrocarbon materials the ordinary form is as illustrated here and is often termed P-H diagram.

How the chart may be used to find the temperature of propane vapor on the low-pressure side of a pressure-reducing valve is illustrated in the following:

Example.—Conditions on the high-pressure side of the valve are 270 psia. pressure at 130° F. Pressure conditions on the low side are maintained at 20 psia. by the throttling of a pressure reducing or regulating valve.

Solution.—To obtain the charted temperature value of the vapor after it has been expanded through the valve enter the chart at the 270-psi. point. Follow the horizontal pressure line for this value until it intersects with the 130° F. constant temperature line at which point move downward and parallel to the enthalpy or total heat lines to an intersection with the 20-psi. line. This intersection point falls slightly less than midway between the 60° and 65° F. constant temperature lines or on approximately 63° F. which is the calculated temperature of the vapor at 20 psia. pressure.

The constant entropy lines on the diagram represent the isentropic process whereas the throttling process is traced by the enthalpy lines. Isothermal processes follow the temperature lines on the chart and constant-pressure processes those of pressure.

Other forms of thermodynamic curves are temperature-entropy or T-S which is often constructed with T, H jointly plotted against S. In diagrams of the latter kind constant volume and constant pressure are the contour curves.

From a strictly technical viewpoint the expansion of a gas from a high-pressure region into a lower-pressure region by means of a pressure regulator or control valve is not a pure throttling process. For overall practical purposes, however, expansion through control valves of the regulator type, such as the foregoing example, may be considered as pure throttling.

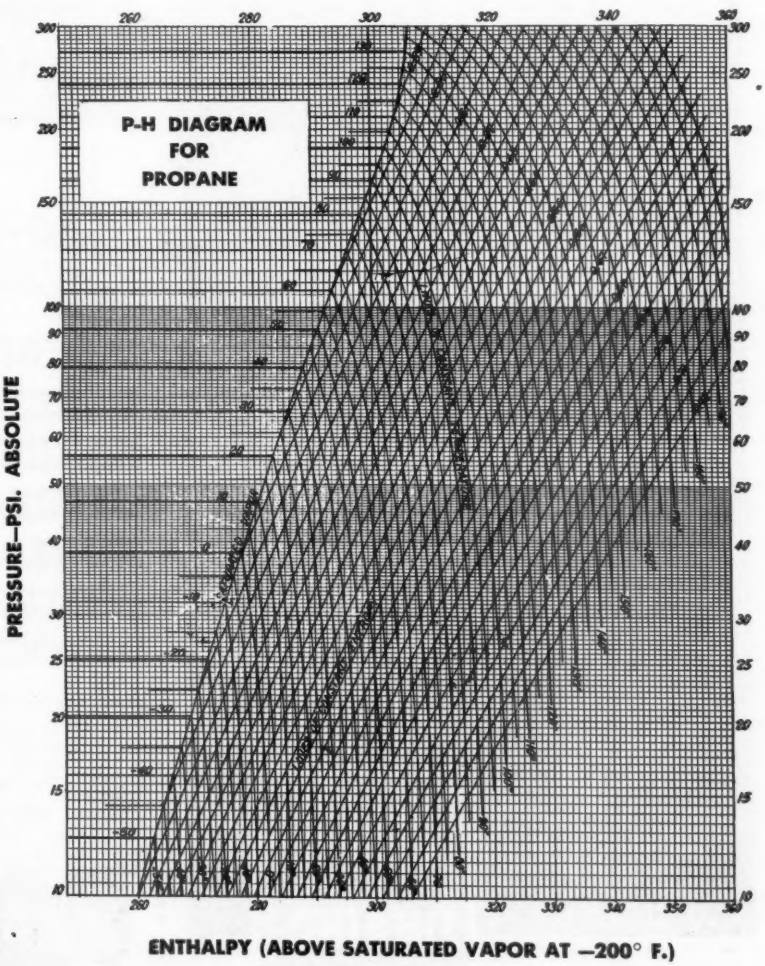
Another Application of the P-H Diagram

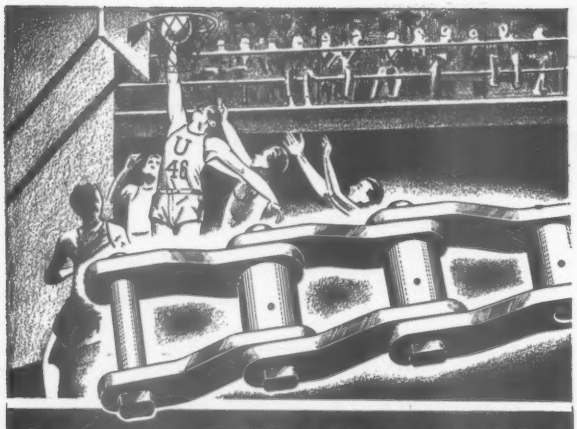
Containers such as tanks or vessels for the storage of liquefied hydrocarbon gases must withstand safely the pressures generated within them by the vapor pressure of the contained liquid. The magnitude of pressure generated within a container depends upon the liquid and its temperature. The pressure generated by the vaporization of typical propane for any temperature between —50° and +130° F. may be read from the Mollier diagram accompanying this article. A typical example of how the diagram may be used to determine the pressure in a vessel containing propane is as follows:

Example.—The temperature of the contents of a tank of propane is shown by a thermometer measurement to be 95° F. What is the pressure against its walls?

Solution.—Follow the 95° F. temperature line on the chart until it intersects the saturated vapor curve and read the value of the absolute pressure line at this point. The pressure for this particular set of conditions is found to be 175 psia. 160 psig. pressure.

Where pressure is known the temperature of the stored liquid may be taken from the chart by reversing the foregoing procedure. If gage pressures are used they must be changed to absolute values by adding 14.7, or more commonly 15 psi., to the gage reading.





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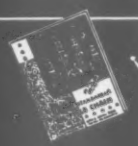

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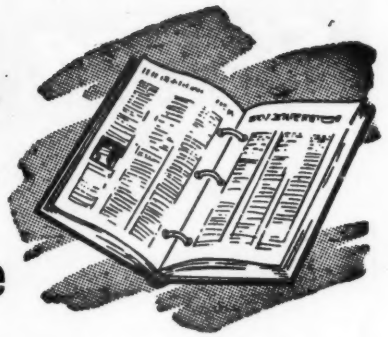
The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL



Exchanger Types—Shell and Tube Bundle

ARRANGEMENTS of surface for the transfer of heat are known by many names which depend to a large extent upon the operation conducted in the equipment, such as:

Exchanger—Oil transferring heat to another oil.

Condensers—Vapor condensed (usually) by water.

Condenser exchanger—Vapor condensed by cooler oil.

Reboiler—Oil being boiled by steam or a hot oil.

Cooler—Oil cooled by water.

After cooler—An exchanger or cooler used after a condenser.

Economical Design

Exchangers, reboilers, condensers, bundles for heating tanks or vessels, and nearly any type of equipment may be constructed as a tube bundle enclosed in a shell. Such a design is usually cheapest because much surface can be provided for the cost of only one shell or housing. If the fluids are passed back and forth (Notebook No. 77) through an exchanger several times, conditions of countercurrent flow may not be attained. Failure to attain countercurrent flow was discussed in Notebooks Nos. 73 (December 22, 1945) and 77 (January 19, 1946). This difficulty is not important for condensers or for equipments in which the quantity of one of the fluids is very large compared to the other. Some difficulty is encountered in cleaning the outside surface of large bundles. Difficulty is also encountered with lengthwise expansion of the tubes in the bundle and hence various means of permitting expansion are necessary. Some methods of permitting expansion are shown in Figs. 1, 2, 3, and 4.

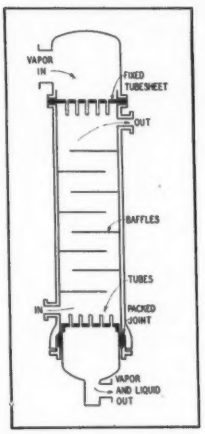


Fig. 1—(Left) Vertical condenser with packed expansion joint. Vapor flows inside the tubes

is excellent from the standpoint of expansion.

An expansion ring, Fig. 2, or an outside packed expansion joint, Fig. 1, can be employed. In these, leaks of one fluid into the other are rare, and leaks at the joints are evident on the outside of the exchanger. Expansion cares for itself in the

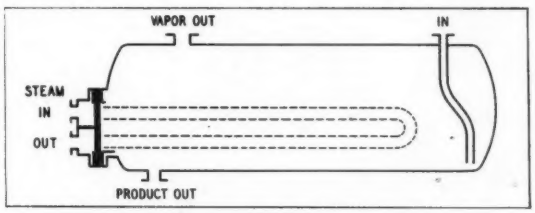


Fig. 4—Reboiler with hairpin tube bundle

Floating Heads

The floating head type shown in Fig. 3 is widely used in petroleum refineries but it is not extensively employed in the chemical industries because leaks of one fluid into the other cannot be readily detected. The materials handled in refineries are not usually pure nor are they expensive whereas many chemical products are extremely pure, they may be exceedingly corrosive, and the reprocessing of them is costly. The same disadvantage arises in any type of equipment in which the return header or bend is emersed in one of the fluids. An example is the housing of tubes and return bends inside of a shell. Such a design is useful for the handling of an extremely high-temperature stream, one which tends to deposit coke, or if the pressure is extremely large, examples are transfer-line exchangers or condenser exchangers for the vapors from a cracking plant evaporator. The floating-head construction of Fig. 3 hairpin tube bundle used in the reboiler of Fig. 4.

The horizontal condenser of Fig. 2 is useful for vacuum or other services in which the pressure drop on the vapor side must be small. If the vapor contains much noncondensable gas the design of Fig. 2 is not best because of accumulation of the noncondensables. It is not well suited to cooling of the condensate and hence it should be followed by a cooler or after cooler. It is well adapted to the use of water that contains salt or slime because the tubes can be easily cleaned, and a high liquid velocity can be attained by the use of many passes.

The vertical condenser of Fig. 1 is useful if only a limited headroom is available. The downflow of the condensing vapor sweeps noncondensable gases ahead of it and gives better liquid cooling than horizontal condensers. High liquid turbulence can be attained by the use of shell baffles.

Hairpin tube bundles for tank heaters, reboilers, etc., can be used only for clean fluids, such as distilled oils, steam or very clean water. The insides of the tubes can be cleaned only by the use of chemicals.

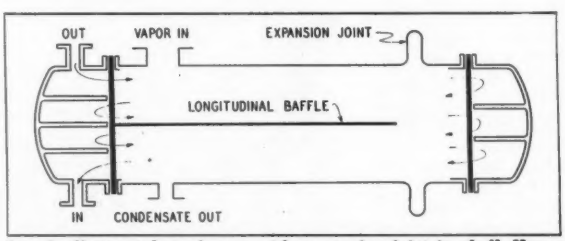


Fig. 2—Horizontal condenser with expansion joint in shell. Vapor flows outside of tubes

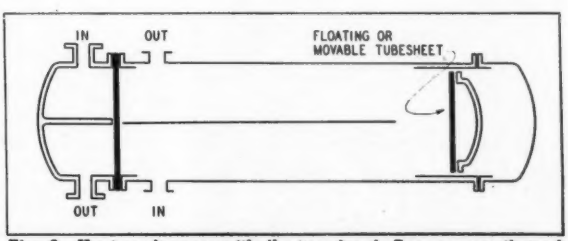
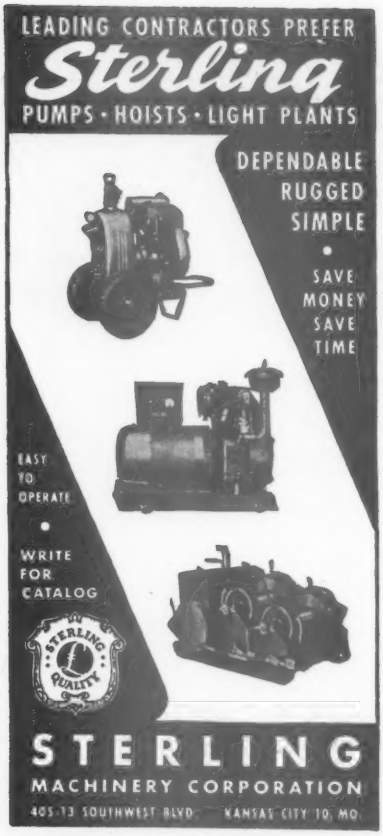
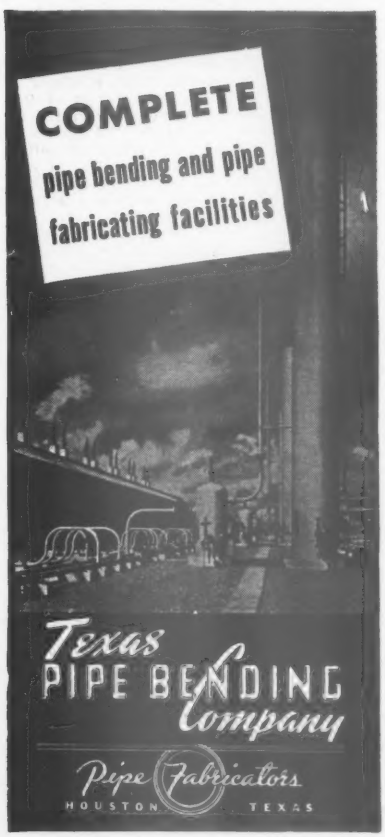


Fig. 3—Heat exchanger with floating head. Two passes through shell and two passes through tubes

No. 80 in a series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa





REFINING

Pressure-Relieving Study To Be Made by School

NEW YORK.—University of Michigan's department of engineering research has been engaged by American Petroleum Institute to conduct an investigation of pressure-relieving systems, analyzing emergency conditions and design procedures for predicting capacity requirements.

The project is to include a survey of existing pressure-relieving systems in petroleum refineries and case histories of both successful operations and failures of these systems. All reference to refineries will be in code known only by the university staff. Engineering principles are to be developed, using the fundamental theories of thermodynamics, fluid flow and heat transfer and these principles will be used to evaluate the practical operating data established by the survey.

Donald L. Katz, professor of chemical engineering, is supervisor of the project for the university, and Nels E. Sylvander, formerly shift superintendent with Ashland Oil & Refining Co., Ashland, Ky., has been employed by the university as research engineer.

This project is sponsored by the A.P.I. subcommittee on pressure-relieving systems under the committee on standardization of refinery equipment. E. O. Mattocks, of Phillips Petroleum Co., is chairman of the subcommittee and D. V. Stroop, of the A.P.I. staff, is secretary.

Socony-Vacuum to Enlarge Research Laboratories

PAULSBORO, N. J.—An expansion program, including construction of a chemistry building, a pilot plant for lubricating oils and a physics laboratory devoted partly to exploring the petroleum industry's uses of nuclear energy and electronic devices, is planned for the Research and Development Laboratories of Socony-Vacuum Oil Co., Inc.

In addition to the physics studies, other fields in which research will be expanded as a result of the program will be petroleum chemistry, fuels and lubricants, gas turbines, and airplane, automobile, diesel and marine engines. The company will continue to maintain technical service laboratories in Brooklyn.

Planned as a guide for later full-size construction, the lubricating oil plant will embody latest refining techniques and equipment such as distillation, solvent refining and dewaxing processes and will be constructed to accelerate wartime developments in lubricating oils. It will be particularly well adapted to production on an experimental basis of such highly specialized products as low-temperature refrigerator oil and hydraulic fluids, said Wilbur F. Burt, Socony-Vacuum vice president in charge of manufacturing.

Ashland's Toledo Refinery Makes Record 343-Day Run

ASHLAND, Ky.—Using a total of 3,531,712 net bbl. of crude, the No. 1 refinery at Toledo of Ashland Oil & Refining Co. made a record run of 343 days in meeting war-stimulated demand for petroleum products. The run was from September 12, 1944, to August 22, 1945, with a record single day's run of 11,999 bbl. John Rosson is operating superintendent.

Tide Water Cracking Unit Sets Operating Record

NEW YORK.—World records for continuous operation of thermofor catalytic cracking units are reported at the Bayonne, N. J., refinery of the Tide Water Associated Oil Co. For its initial run, catalytic cracking unit No. 8 at the Bayonne refinery oper-

ated at full capacity for 240 days without shutdown, surpassing the record of 217 days for any previous run by a thermofor catalytic cracking unit. Simultaneously it exceeded the preceding record of 146 days for an initial run, according to Herbert Chase, vice president in charge of manufacturing in the company's eastern division.

Antifoam Agent Lengthens Usefulness of Engine Oil

PITTSBURGH.—Development of an antifoam agent to prevent formation of oil-bubble foam, which causes lubrication failures in high-speed engines, has been achieved in the research laboratories of Gulf Oil Corp., the company announces.

Bubbles are created by the movement of gears and bearings from air mixed with the oil. Diffused through the oil, the new product reduces surface tension and allows the bubbles to break quickly on reaching the surface. The company points out that frozen engines, halted tank maneuvers, and restricted operation of warships and aircraft have resulted from oil foam through destruction of the protective coating of lubricating oils.

Designed originally for use in high-speed commercial turbines, diesel engines, and stationary power plants, the antifoam agent is being added to oil sold for use in private cars.

Variety of Papers Slated For Refiners Meeting

Papers on a variety of subjects, including catalytic cracking for the medium and small refiner, crude oil desalting by heat and pressure, and metallurgy for alloys used in refining operations, will be presented at the 34th annual meeting of the Western Petroleum Refiners Association March 25-27 at the Blackstone Hotel in Fort Worth.

In addition to the technical meetings which begin the morning of March 26, refiners at the meeting will also discuss petroleum taxes, oil installations in Japan, and other subjects, according to J. C. Day, secretary.

Bright Stock Production Of 219,094 Bbl. Reported

Statistics on lubricating oil from the Western Petroleum Refiners Association for December show production of bright stock at 219,094 bbl. and of viscous neutrals at 271,048 bbl. Inventories of the two products at the end of the month were 352,311 and 256,235 bbl. respectively. For paraffin oils, the figures covering the 13 reporting companies in the Mid-Continent area listed production at 73,536 bbl., for steam refined stock at 20,005 bbl. and for blended oils at 309,808 bbl.

Inventory totals for these three products were given as paraffin oils, 67,489 bbl.; steam refined stock, 40,504 bbl.; and blended oils, 183,019 bbl. The bright stock and viscous neutrals inventories represent, respectively, a 48 and a 25-day supply.

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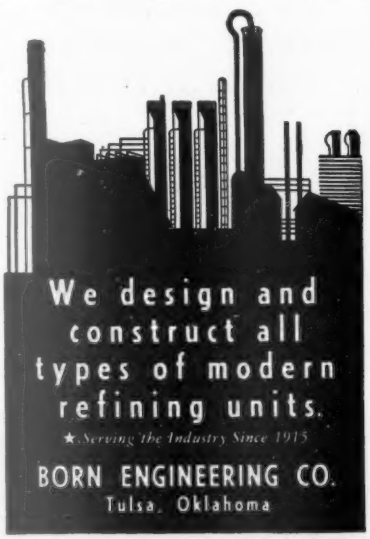
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PIPE LINES

Williams Firm Takes Over Big-Inch Maintenance

WASHINGTON.—Williams Brothers Corp., Tulsa pipe-line contractor, will take custodial charge of the Government's $119,000,000 big-inch pipe lines until Congress definitely decides the future of the war-built system.

Under a contract negotiated between the Reconstruction Finance Corp. and the firm, Williams Brothers will maintain the 3,000 miles of line and associated installations in operating condition. Oscar Burden, former general superintendent for the War Emergency Pipelines, Inc., will be in charge for the company with headquarters in Cincinnati, according to G. S. Conners, Williams Brothers vice president.

The company, which built about a third of the lines and most of the river crossings, will use about 200 employes, including patrols, corrosion crews and other maintenance workers. Many former WEP employes will be taken after their release, Conners said. The lines at present are filled with an inert gas with a corrosion inhibitor. RFC recently authorized the Army-Navy Petroleum Board to use the Baytown-Beaumont little big-inch gathering system for storage of 2,000,000 bbl. of high-octane gasoline, in order to relieve overtaxed refinery storage facilities.

Purchase of Coffeyville Lines Proposed to FPC

WASHINGTON. — Permission to purchase and operate a gas pipe line system near Coffeyville, Kans., is requested of the Federal Power Commission by Union Gas Systems, Inc., Independence.

The system, now owned and operated by Independent Industrial Gas Co. and Veeder Supply & Development Co., consist largerly of lines extending north and east from Coffeyville to local distribution plants in seven smaller communities. Purchase price was placed at $150,000. The system is adjacent to Union's present facilities.

FPC Approves Connection For Kentucky Natural

WASHINGTON.—To meet its peak winter day demands, the Kentucky Natural Gas Corp. has been authorized by the Federal Power Commission to operate an existing pipe line connection in Barren County, Kentucky.

Kentucky will receive a maximum of 6,000,000 cu. ft. of gas daily from Tennessee Gas & Transmission Co. through the connection. Only new facilities required are the installation of heavy-weight gate valves on Kentucky's 6-in. connection line.

35-Mile Gwinville Extension Completed for Interstate

BROOKHAVEN, Miss. — Interstate Oil Pipe Line Co.'s 35-mile extension to carry crude from Gwinville field in Jefferson Davis County to Mallalieu field northeast of here was practically complete this week.

The 10-in. line is a part of Interstate's Mississippi network connecting the refinery of Standard Oil Co. of New Jersey, Louisiana division, at Baton Rouge with five producing fields in Mississippi and two in west central Louisiana. The new extension project also embraces an additional 2½ miles of 6-in. gathering

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lines in the Gwinville field. Normal capacity of the main extension is 43,000 bbl. daily.

Interstate's New System Connects Wyoming Fields

BILLINGS, Mont. — The southern Montana pipe line system acquired by Interstate Oil Pipe Line Co. from Yale Oil Pipe Lines, Inc., is now carrying crude from two fields in northern Wyoming as well as from the Elk Basin.

Interstate which has been managing the Yale company for the last year was joined by 19 Yale employes with completion of the merger. The Yale system includes 51 miles of 8-in. line from Warren to a Carter Oil Co. refinery at Billings, 14 miles of 6-in. line to the Farmers Union Central Exchange, Inc., refinery at Laurel, and a 12-mile link from Warren to Elk Basin.

In addition to this system, Interstate completed another line south from Warren through Frannie field in northern Wyoming, and an Ohio Oil Co. extension from the Frannie station carries crude from the Byron pool southwest to Lovell, Wyo. A short 12-in. line across the Montana-Wyoming border connects Interstate's Elk Basin station with Ohio's east-west line.

Moore Made Pipe Line Head For Ohio; Bunje Retires

FINDLAY, Ohio.—O. F. Moore, assistant manager of the pipe line department and assistant secretary of Ohio Oil Co., has been made a vice president and pipe line department manager succeeding Charles Bunje, Jr., who retired.

Bunje's retirement came after the completion of 39 years continuous service with the company.

Natural Gas Line Proposed From Lispe to Budapest

Construction of a $2,000,000 pipe line to carry natural gas from the Lispe oil field to Budapest, Hungary, has been proposed by an unnamed foreign company, according to a report received by the Bureau of Foreign and Domestic Commerce.

The company made its offer to Budapest municipal officials, asking a 99-year concession for the gas supply in return for meeting the cost. The line would carry 282,480,000 cu. ft. annually, the report said.

The Lispe field recently became a center of international attention when the Red Army which is occupying the area barred officials of the Standard Oil Co. (N.J.) from properties of its Hungarian affiliate. Standard and the Russians each charged the other with wasteful production methods.

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CHICAGO 40, ILLINOIS

Natural Gas

Pacific Gas & Electric Cuts Rates $3,500,000 Annually

SAN FRANCISCO.—Pacific Gas & Electric Co. will reduce natural-gas rates beginning with the February 28 meter readings, effecting a saving to customers of about $3,500,000 a year. The cut, ordered by California Railroad Commission, amounts to an average of 10.3 per cent on general-service customers, who represent about 99 per cent of those on the company's gas lines.

The new schedule will favor communities which have high population growth with increased density, in some running to 25 per cent.

The commission opinion says, "Such a reduction will leave the company in earnings position sufficient to meet its financial requirements and will provide not less than a reasonable return on fair value of its gas properties."

San Diego Demand Met By New Compressor Station

LOS ANGELES.—Capacity of the San Diego pipe line of the Southern Counties Gas Co. was increased to 37,000,000 cu. ft. daily when the company's new $204,000 Dana Point compressor plant was placed in operation. The San Diego line formerly had a capacity of 26,000,000 cu. ft. daily.

The compressor station embodies such features as automatic controls to regulate the engine in proportion to demand, cooling of engine oil, water, and gas by a radiator to eliminate steam or fog from the conventional cooling tower, and muffler equipment to deaden exhaust noises.

The compressor itself is a 1,000-hp. Cooper-Bessemer 10-cylinder two-cycle gas engine.

Rubber, Plastics from Gas Sought by Texas Chemist

AUSTIN. — Discovery of commercially practicable processes of synthesizing rubber and plastics from natural gas are the goal of experiments being conducted at the University of Texas by Dr. E. P. Schoch, well-known 74-year-old research chemist.

With the development of the Schoch process for making acetylene from natural gas already to his credit, Schoch is now completing experiments begun in 1929 which hold the promise of multiplying the value of the raw material 40 times. He is working with methane, the principal ingredient of gas.

The electrical discharge process, which is used in making acetylene, can be adapted, Dr. Schoch said, to many products. He believes it important to find products which will add to the value of natural gas.

"In dealing with methane, we must seek to make plastics and rubber, rather than gasoline, because in making gasoline, the value of the natural gas used is likely to be only doubled, but in making plastics or rubber, its value will be multiplied by 40," he said.

New Shell Projects to Save 17,000,000 Cu. Ft. Gas Daily

BATON ROUGE. — Approximately 17,000,000 cu. ft. of gas now being vented will be saved daily with the completion of improvement projects by Shell Oil Co., Inc.

Joseph L. McHugh, conservation commissioner, said venting of the gas from company oil wells will be eliminated with the installation of additional compressors having 1,425-hp. capacity to boost low-pressure gas into pipe lines.

West Edmond Gas-Oil Ratio Revised by Commission

OKLAHOMA CITY.—Revising its emergency order, the Oklahoma Corporation Commission has set the maximum gas-oil ratio for the Hunton lime zone of the West Edmond field at 3,072 ft. of gas per barrel of oil. In approving the recommendation, the commission made the order retroactive to January 1. Under the emergency order the ratio maximum was increased from 2,000-to-1 to 3,364-to-1.

December Gas Sales Show Decline of 1.9 Per Cent

NEW YORK.—Although December sales of natural gas dropped 1.9 per cent from the corresponding month of 1944, they still stood at 174.1 per cent of the 1935-1939 average in the index of the American Gas Association.

December sales amounted to 2,169,248,700 therms (1 therm equals about 100 cu. ft.), compared to 2,210,660,300 therms for December 1944, according to an association report. For all 1945, sales of 22,328,360,600 therms represent an increase of 0.7 per cent over 1944. Sales of both manufactured and natural gas totaled 2,459,966,300 therms in December, a decrease of 1.6 per cent from December 1944.

FPC Disapproves Rates Proposed by North Penn

WASHINGTON. — Wholesale gas rate increases proposed by North Penn Gas Co. and its affiliate, Allegany Gas Co., have been disapproved by Federal Power Commission on the ground that they would result in "unlawful discrimination" because of the wide variation in costs to interstate customers.

The commission's opinion said rate schedules "producing approximately the same revenues but without the discriminatory feature of the suspended schedules would be reasonable." It set up a scale ranging from 44 cents per 1,000 cu. ft. for the first 1,000,000 cu. ft. to 40 cents per 1,000 for all over 45,000,000 and ordered North Penn and Allegany to file new schedules by February 1. The two companies operate as a single system under one management serving retail and wholesale customers in northern Pennsylvania and southern New York.

Natural Gasoline

Natural Gasoline Production Continues Gain in November

WASHINGTON.—Production of natural gasoline and allied products continued its upward trend during November 1945 with 73.45 per cent of the increased output going into storage, according to a Bureau of Mines survey. Daily average production was 12,927,000 gal. during the month, compared to 12,230,000 in October. Largest production gains were in Texas Panhandle, Louisiana, California, and Oklahoma. Stocks increased 15,385,000 gal. to 181,638,000 on November 30. Total stocks, however, were 390,000 gal. less than at the same time in 1944.

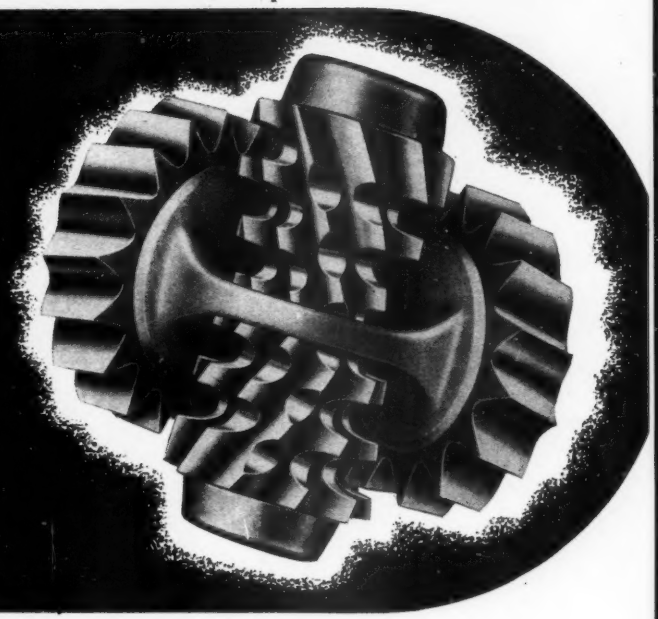
PRODUCTION
(Thousands of gallons)

	Nov.	Oct.
Natural gasoline	199,081	185,444
Natural gasoline mixture	26,507	26,636
Raw condensate	30,109	33,171
Liquefied petroleum gases:		
Commercial butane-propane mixture	29,869	26,386
Normal butane	26,595	31,883
Propane	24,335	24,704
Other mixtures (LPG)	10,941	12,011
Isobutane	13,658	11,668
Isopentane	3,743	2,448
Finished gasoline and naphtha	19,768	22,431
Other products	3,219	2,361
Total	387,825	379,143

H C Smith

FORMATION PROVED

ROCK BITS



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STATISTICS and

WEEKLY WELL COMPLETIONS . . . WEEK ENDED FEBRUARY 2, 1946

	Total of all wells					Cum. to date		Wildcat completions and discoveries					Cumulative total, 1946				
	Comp.	Oil	Gas	Dry	Footage	1946	1945	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	26	14	0	*12	47,153	143	140	0	0	0	0	0	0	0	0	0	0
Pennsylvania	72	31	4	†37	113,397	361	235	0	0	0	0	0	0	0	0	0	0
West Virginia	9	3	6	0	22,254	53	115	0	0	0	0	0	0	0	0	0	0
Ohio	25	6	8	11	64,485	90	64	0	0	1	0	1	0	0	3	5	8
Indiana	4	2	0	2	7,396	27	18	0	0	0	0	0	0	0	0	4	4
Kentucky	9	4	3	2	16,217	42	30	1	0	0	2	3	1	0	0	7	8
Illinois	28	19	0	9	66,120	182	194	0	0	0	5	5	3	0	0	37	40
Michigan	11	6	0	5	33,347	64	66	0	0	0	3	3	0	0	0	21	21
Kansas	46	31	3	12	150,175	217	137	0	0	1	3	4	1	0	1	30	32
Neb., Mo., Iowa	0	0	0	0	0	1	6	0	0	0	0	0	0	0	0	1	1
Oklahoma	36	22	3	11	156,805	225	223	0	0	0	3	3	7	0	2	37	46
Texas	118	70	9	39	618,461	731	624	0	0	2	19	21	9	0	4	107	120
North Central	34	20	1	13	81,611	259	190	0	0	0	5	5	3	0	0	32	35
West	24	22	0	2	125,769	156	153	0	0	0	0	0	3	0	0	14	17
Panhandle	5	3	0	2	16,415	33	50	0	0	0	1	1	0	0	0	2	2
Eastern	8	3	2	3	43,248	68	23	0	0	0	2	2	1	0	0	14	15
Gulf Coast	41	21	5	15	324,405	175	153	0	0	2	9	11	1	0	2	32	35
Southwest	6	1	1	4	27,013	40	55	0	0	0	2	2	1	0	2	13	16
Louisiana	24	18	1	5	165,356	109	83	0	0	0	3	3	8	1	0	10	19
Northern	16	11	1	4	89,683	56	27	0	0	0	3	3	2	0	0	7	9
Southern	8	7	0	1	75,673	53	56	0	0	0	0	0	6	1	0	3	10
Arkansas	3	3	0	0	19,866	12	16	0	0	0	0	0	0	0	0	1	1
Mississippi	5	2	0	3	31,423	24	29	0	0	0	2	2	0	0	0	6	6
Southeastern States	1	0	0	1	12,985	7	2	0	0	0	1	1	0	0	0	6	6
Montana	4	3	0	1	7,686	26	29	0	0	0	0	0	0	0	0	1	1
Wyoming	4	0	0	4	22,143	17	22	0	0	0	3	3	1	0	2	7	10
Colorado	1	0	0	1	8,350	11	4	0	0	0	1	1	0	0	0	2	2
New Mexico	6	5	0	1	22,755	42	47	1	0	0	1	2	1	0	0	4	5
California	36	28	0	8	145,354	177	221	0	0	0	4	4	0	0	1	23	24
Total United States	468	257	37	164	1,731,728	2,561	2,305	2	0	4	50	56	31	1	13	309	354
Total previous week	528	285	50	193	1,778,394	2,093	1,857	7	1	2	73	83	29	1	9	259	298
Total Feb. 3, 1945	448	253	42	153	1,572,796	2,305	1,690	12	0	4	53	69	53	0	12	321	387

Service wells included: *12, †36.

MARKET QUOTATIONS

(This service is abbreviated because most refinery products are selling at the Government's price ceilings. Quotations on other products than those shown here furnished on request. Quotations are f.o.b. plant in tank cars and in cents per gal. as of last Monday.)

REFINERY GASOLINE

Octane (A.S.T.M.)	78-80†	73-75
Mid-Continent*	6.125-6.375	5.375-5.75
Gulf Coast	6.75	5.75-6.250
Northeast Coast		9.875
California		6.50-7.00

*Basic Oklahoma Group 3. †1939 C.F.R. (research method).

NATURAL GASOLINE

Grades:	26-70	18-55
Oklahoma (Group 3)	3.500	4.200
N. Texas (f.o.b. plant)	3.000	3.600
N. Louisiana (f.o.b. plant)	3.375	4.050
California	4.875	5.500

CRUDE-OIL PRICES

Representative posted schedules per bbl.

East Texas	$1.25
Conroe	1.43
Tepetate, Louisiana, avg. grav.	1.20
Illinois Basin	1.37
Pecos County, Texas	.95
Bradford, Pennsylvania	3.00
Van, Van Zandt County, Texas	1.08

Note: Exclusive of subsidy.

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Oklahoma, Kansas	Gulf Coast Texas	West Tex.*
18-18.9	$0.80	....	....	....
19-19.9	.84	....	$1.06	$0.70
20-20.9	.88	$0.85	1.08	.72
21-21.9	.92	.87	1.10	.74
22-22.9	.96	.89	1.12	.76
23-23.9	1.00	.91	1.14	.78
24-24.9	1.03	.93	1.16	.80
25-25.9	1.07	.95	1.18	.82
26-26.9	1.11	.97	1.20	.84
27-27.9	1.15	.99	1.22	.86
28-28.9	1.18	1.01	1.24	.88
29-29.9	1.20	1.03	1.26	.90
30-30.9	1.23	1.05	1.28	.92
31-31.9	....	1.07	1.30	.94
32-32.9	....	1.09	1.32	.96
33-33.9	....	1.11	1.34	.98
34-34.9	....	1.13	1.36	1.00
35-35.9	....	1.15	1.38	1.02
36-36.9	....	1.17	1.40	1.04
37-37.9	....	1.19	1.42	1.06
38-38.9	....	1.21	1.44	1.08
39-39.9	....	1.23	1.46	1.10
40 and above	....	1.25	1.48	1.12

*Includes Lea County, New Mexico.

A.P.I. REFINERY REPORT

Week ended January 26, 1946
(Figures in thousands of barrels)

	Dly. crude runs to stills	Stocks—Gasoline	Distillate	Residual
East Coast	747	21,389	8,399	6,098
Appalachian	144	4,040	653	467
Ill., Ind., Ky.	710	21,322	4,307	2,494
Okla., Kan., Mo.	385	9,600	1,516	1,041
Inland Texas	219	2,980	308	658
Tex. Gulf Cst.	1,059	17,238	5,184	4,217
La. Gulf Coast	285	5,251	1,603	1,215
N. La., Ark.	60	2,026	515	240
Rocky Mtn.	131	2,110	392	749
California	813	15,781	6,621	22,543
Total 1-26-46	4,553	101,737	29,498	39,722
Total 1-19-46	4,627	100,778	31,403	40,557
Total 1-27-45	4,766	90,222	32,668	50,801

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended:	Bbl. of crude*
January 19, 1945	219,709,000
January 12, 1946	219,219,000
January 27, 1945	221,310,000

*Excludes unrefinable Calif. stocks.

TRENDS

DAILY AVERAGE PRODUCTION FOR WEEK

	Feb. 2 crude oil	Bureau of Mines demand forecast	Jan. 26 crude oil
Alabama	650	500	650
Arkansas	77,050	74,000	76,850
California	840,350	844,000	837,500
Colorado	23,090	24,000	22,150
Eastern	59,950	61,200	63,300
Florida	100	100	100
Illinois	207,800	198,000	206,500
Indiana	15,100	13,000	14,700
Kansas	239,600	254,000	254,450
Kentucky	29,500	29,000	29,700
Louisiana	368,650	368,000	368,750
North Louisiana	79,800	.....	79,900
South Louisiana	288,850	.....	288,850
Michigan	44,370	46,000	46,750
Mississippi	56,750	49,000	54,300
Montana	21,670	20,400	22,000
Nebraska	750	800	750
New Mexico	100,350	96,000	100,350
Oklahoma	387,400	368,000	392,650
Texas	2,000,800	1,890,000	2,000,800
East Texas	320,000	.....	320,000
East Central Texas	140,050	.....	140,050
North Central Texas	152,800	.....	152,800
Texas Panhandle	81,000	.....	81,000
West Texas	489,300	.....	489,300
Southwest Texas	328,900	.....	328,900
Texas Gulf Coast	488,750	.....	488,750
Wyoming	89,410	94,000	92,200
Total United States	4,563,340	4,430,000	4,584,450

Change from prev. wk., down 21,110

Total production January 1-February 2, 1946 ..... 132,493,240 bbl.
Same period last year ..... 155,624,850 bbl.

CRUDE-OIL STOCKS 219,709,000 bbl. as of Jan. 19—up 490,000 bbl. One year ago 221,646,000 bbl.

GASOLINE STOCKS 101,737,000 bbl. as of Jan. 26—up 959,000 bbl. One year ago 90,222,000 bbl.

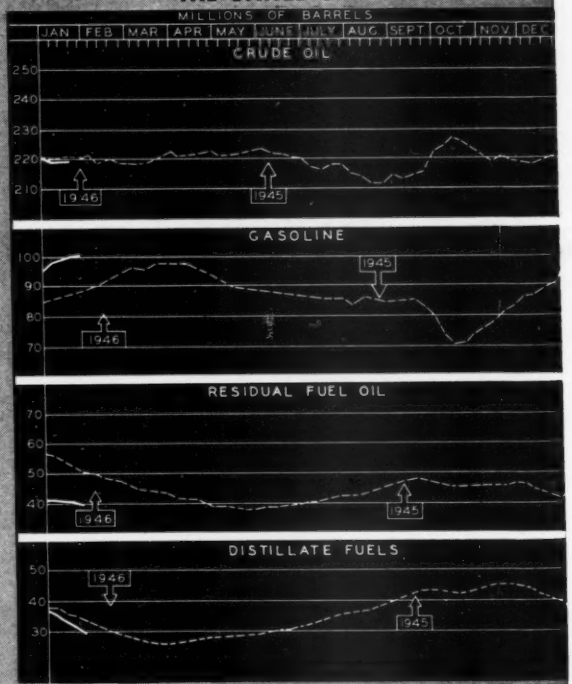
RESIDUAL FUEL-OIL STOCKS 39,722,000 bbl. as of Jan. 26—down 835,000 bbl. One year ago 50,801,000 bbl.

GAS OIL AND DISTILLATE STOCKS 29,498,000 bbl. as of Jan. 26—down 1,905,000 bbl. One year ago 32,668,000 bbl.

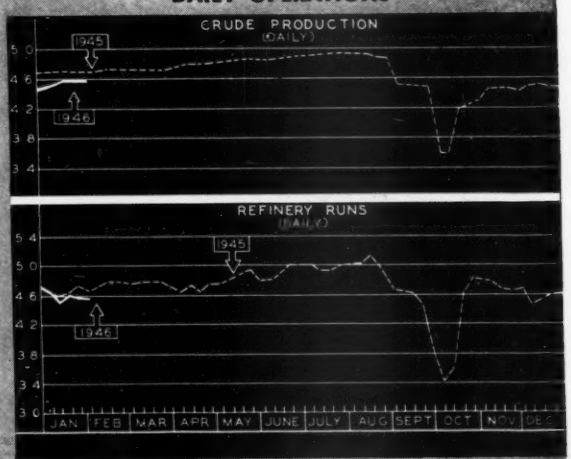
CRUDE-OIL PRODUCTION 4,563,340 bbl. as of Feb. 2—down 21,110 bbl. One year ago 4,733,300 bbl.

REFINERY RUNS 4,553,000 bbl. daily week ended Jan. 26—down 74,000 bbl. One year ago 4,766,000 bbl.

OIL STOCKS IN THE UNITED STATES



DAILY OPERATIONS



Solid line charts weekly completions, service wells in Eastern area included

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No engine should be wilfully neglected, but when through oversight or carelessness proper attention is not given it, the CSCO-66 engine can be depended on to *keep on* operating day after day as long as it is given fuel, oil and water.

Starting is easy in any weather. Oil and water can be added while engine is running. Positive force-feed lubrication, mechanically operated intake valves and 12 other points of superiority have already put the CSCO-66 Series in high favor wherever wells go on pump. Write factory or nearest distributor for fully descriptive bulletin. Climax Engineering Company, General Offices, Clinton, Iowa. *Regional Offices: Chicago, Tulsa, New York.*

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Exploration and Drilling

Louisiana Prospects Look Good

WITH two important successful wildcat completions almost certain in Beauregard Parish, and a red-hot prospect in Rapides Parish, Louisiana exploration prospects, already bright from results in the Delhi area, and the extension of the salt dome play from Mississippi, gave signs that the Pelican state would not permanently yield third place in production to Oklahoma without a struggle.

Another new field was practically assured for Beauregard Parish as Magnolia Petroleum Co. 2-C Lutcher Moore Lumber Co., NE SE 22-5s-11w, flowed 130 bbl. per day of 46° gravity oil. Total depth 11,625 ft., plugged back to 7,640 ft., on test the well flowed 130 bbl. through 7/64-in. tubing choke, tubing pressure 1,150 lb., casing sealed, gas-oil ratio 830.

This test is 4 miles west of the West Pinegrove field, which was opened in February, 1945. The new test, however, is producing from the Cockfield, and was dry in the Wilcox, which produces at about 11,300 ft. in West Pinegrove.

The second new field, or possibly a 2-mile northeast extension to the Oretta field, is being opened by Magnolia 1 Witski, SE NW 22-6s-11w, Beauregard Parish. On drill-stem test, this well flowed about 100 bbl. daily, from perforations at 8,422-26 ft., and was waiting on tankage to take a flow test from this section and additional perforations at 8,431-35 ft., all in the Lower Cockfield.

The Oretta field, now producing from four wells, was discovered in March 1945, and also produces from the Lower Cockfield, but the pay is at about 8,700 ft., or some 300 ft. lower than the new test. Whether the pay is the same in the New Magnolia test as at Oretta, and running much higher, whether a new field, or whether an extension and a new pay for Oretta remain questions to be answered. Complicating the problem is a 12,000 ft. dry hole in the SE SW of Sec. 22, between the latest discovery, and the Oretta field proper.

In northeast Rapides Parish, Union Producing Co. et al 1 Belgard, Sec. 14-4n-3e, is reported looking good in the Marine Tuscaloosa, between 9,700-800 ft. Geologists familiar with the area are keenly interested. This test is almost due east, and across the Parish, from the Flatwoods field, a 1945 Wilcox discovery of last July.

TEXAS GULF COAST

Production Opened on South Edge of El Campo

HOUSTON.—Production has been opened on the south edge of the El Campo field in Wharton County by Seaboard Oil Co. of Delaware at 2-A Reba S. Snell, in the E. T. Wilson Survey, Abstract 567. Drilled to a total depth of 6,956 ft., with 5½-in. casing cemented at 6,891 ft. this well gaged 194 bbl. of pipe-line oil daily through a ⅛-in. choke, tubing pressure 1,075 lb., and casing pressure 1,275 lb. Production is through 24 perforations at 6,662-66 ft.

W. L. Goldston extended production at Needville to the northwest at 1 J. F. Kulcak, in the Robert Hodge Survey. Final test has not been made but on initial gage the well flowed approximately 25 bbl. of 27° gravity oil daily through a ⅛-in. choke with 1,750 lb. flowing pressure on tubing. Total depth is 6,606 ft. with 5½-in. casing on bottom.

The link well between Withers and Lane City fields in Wharton County, The Texas Co. 120-C Pierce Estates, gaged a potential of 84 bbl. of 24° gravity oil through a 7/64-in. choke with 550 lb. pressure on tubing and 920 lb. pressure on the casing. Production is from open hole at 5,382-420 ft. Total depth is 5,420 ft. Sand was topped at 5,416 ft. and the 5½-in. casing was cemented at 5,382 ft.

Another flank producer at High Island field in Galveston County, on the southwest flank, has been completed at John W. Mecom 3 Cade et al, in W. M. Hudson Survey. Total depth is 6,477 ft. and 7-in. pipe is cemented on bottom. Initial gage was 361 bbl. of oil in 24 hours through a 3/16-in. choke with 900 lb. flowing pressure on the tubing and 950 lb. pressure on the casing. Production is through perforations at 6,341-47 ft.

Twelve new locations were reported this week with Brazoria, Hardin, Harris, and Jefferson counties receiving two each. Waller and Wharton counties each received one wildcat location. There were seven dry wildcats completed, two each in Jackson and Matagorda counties, and one each in Harris, Newton, and Trinity counties. Of the 25 completions reported, 12 were oil, 1 gas, and 12 dry. Brazoria, Jefferson, and Matagorda counties received the greatest activity with three completions each.

WILDCAT FAILURES UPPER GULF COAST

Harris County: Paul F. Rutledge and Harris T. Clark 1 Joseph F. Meyer, H. Aiken Sur., Abst. 98, 3½ mi. SW of Bellaire, dry, TD 7,503 ft.

Jackson County: Monday Oil Co. 1 Mary Hillman, Joseph Rector Sur., dry, TD 7,002 ft.

Crown Central Petroleum Corp. 1 Lucile Hensley Seale, Josiah H. Bell Sur., 6 mi. S of Lolita, dry, TD 8,507 ft.

Matagorda County: Amerada Petroleum Co. and Sun Oil Co. 1 W. T. Morrison et al, John Holmes Sur., Abst. 191, 3 mi. SE of Blessing, dry, TD 12,221 ft.

Skelly Oil Co. 1 J. G. Long, East Bay City area, in I&GN Sur. 2, Abst. 275, Block 5, dry, TD 12,507 ft.

Newton County: Fred M. Manning and The Yegua Corp. 1 H. B. Funchess, Jr., Armond Davis Sur. 3, dry, TD 7,556 ft.

Trinity County: American Liberty Oil Co. 1 Houston County Timber Co., Alexander Henry Sur., Abst. 822, dry, TD 8,343 ft.

N. CENTRAL TEXAS

Young Co. Test Completed To Flow 81 Bbl.

WICHITA FALLS. — Hanlon-Buchanan, Inc., and Ben Rankins 1 Mary Logan, J. Poitevent Survey, Abstract 288, wildcat 8 miles northeast of Graham, Young County, has been completed to flow 81.26 bbl. of 41° gravity oil in 24 hours. Gas-oil ratio was 1,700 to 1. Production is through perforations from 4,007-12 ft. in the Caddo. The Crain pool of northern Young County has been extended ¼ mile north by L. T. Burns 1 Dunagan, Block 170, TE&L Survey. The well is a large producer, flowing 250 bbl. of oil in 3 hours through ½-in. tubing choke. Production is through perforations from 5,048-64 ft.

Continental Oil Co. 1 Jarrell, Block 3433, TE&L Survey, wildcat 5 miles southwest of Bowie, southwestern Montague County, is dry at 7,095 ft. Standard Oil Co. of Texas 2 Beasley, J. McKerley Survey, deep test in the Sivells Bend pool of northern Cooke County, ran a 30-minute drill-stem test from 8,905-34 ft. in the Ellenburger. Recovery was 120 ft. of free oil and 60 ft. of drilling mud. Ellenburger was topped at 8,640 ft. It was drilling below 9,156 ft. In the same area Standard of Texas 3 Beasley on a 30-minute drill-stem test from 6,939-51 ft. had a fair blow of air and recovered 30 ft. of clean oil, 30 ft. of oil-cut mud and 30 ft. of salt water. Seven-inch casing has been set at 7,050 ft.

Electra and KMA fields, Wichita County, each reported four completions this week. Gatewood field, Cooke County, had three, and Wilson field, Cooke County, had two. Electra field had six locations, Gatewood field four, and Thomas field, Archer County, had two. Sivells Bend field, Cooke County, has 10 drilling wells; Hildreth field, Montague County 9, Cooper field, Archer County, and National field, Wilbarger County, 6 each.

In West Central Texas, Cisco field, Eastland County, reported two completions, and Wimberly field, Jones County, and Reddin field, Taylor County, each one. Wimberly field, Reddin field, and Santa Anna field, Coleman County, each had one location. Stephens County has 16 drilling wells, 6 in Stephens County Regular field, 2 in Loving field, and 8 wildcats. Jones County has 13, 3 in Jones County Regular field, 2 in Noodle field, and 8 wildcats.

NORTH CENTRAL TEXAS WILDCAT FAILURES

Archer County: Timberlake & Kelleher 1 L. F. Wilson, Sec. 114, ATNCL Sur., 6 mi. N and W Archer City, dry at 1,505 ft.

Jack County: Hanlon-Buchanan, Inc. 1 C. Melugin, Jno. S. Porter Sur. A-466, 4 mi. S Antelope, dry at 689 ft.

Montague County: S. D. Johnson et al 1 Gibson & Jennings, Blk. 77, Kaufman CSL Sur. A-407, 7 mi. E and 3 mi. N Nocona, granite wash 4,350 ft., dry at 4,390 ft.

Throckmorton County: Nu-Enamel Oil Operating Co. 1 S. R. McWhirter, Sec. 3020, TE&L Sur., 5½ mi. W and ½ mi. S Elbert, Mississippian 4,895 ft., dry at 4,903 ft.

Wilbarger County: National Assoc. 1 Mueller, Sec. 55, Blk. 12, H&TC Sur., 3 mi. N and E Vernon, elev. 1,268 ft., dry at 5,507 ft.

APPALACHIAN FIELD

Beaver County Wildcat Finds Gas In Berea

PITTSBURGH. — In South Beaver Township, Beaver County, southwest Pennsylvania, Beaver Hill Oil & Gas Co. drilled through the Berea in the Oriskany wildcat on C. C. Kennedy farm and found a show of gas and some water at 948-65 ft. It is now drilling at 2,106 ft.

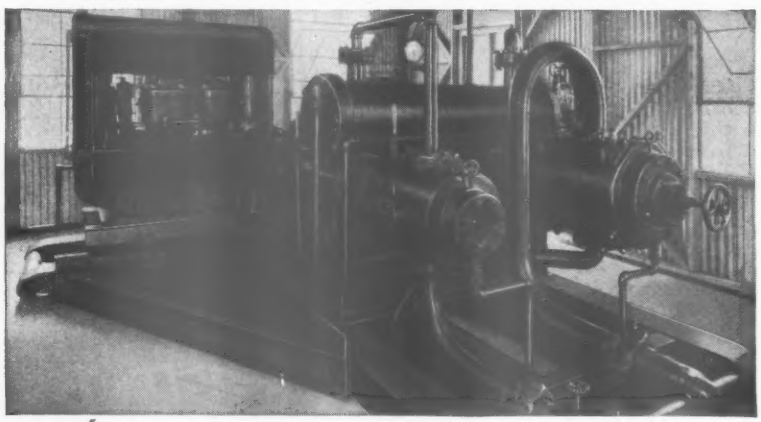
During the week six new locations were announced scattered in Kittanning and Wayne townships, Armstrong County; Washington Township, Indiana County; North Strabane and West Bethlehem townships, Washington County.

In Harts Creek district, Lincoln County, Owens Libby Owens Gas Department completed a good gas well, the 710 Koontz Realty Co., with a final open flow of 2,524,000 cu. ft. gas from the Brown shale, total depth 3,722 ft.

In Murphy district, Ritchie County, Hope Natural Gas Co. completed 5,583 James T. Johnson for 762,000 cu. ft. gas from the Injun sand, total depth 2,049 ft.

In Dry Fork district, Tucker County, Ohio Oil Co. landed a string of 7-in. casing at 8,305 ft. in the wildcat on Kuykendall Unit. The Oriskany sand was topped at 8,250 ft. Due to difficulty in maintaining the uncased part of the hole, the casing was run through the hard part of the sand with the possibly productive part to be explored.

In Elk district, Kanawha County, United Carbon Co. drilled through the Oriskany sand in the test on Charleston National Bank lease with no gas showing. The sand was placed at 5,200-77 ft.



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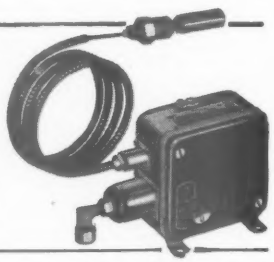

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SOUTHWEST TEXAS

Atlantic Test Flows 19 Million Feet of Gas

CORPUS CHRISTI. — Potential test has been reported for Atlantic Refining Co. 1 James H. Ewing, discovery well for North Minnie Bock field. This well is located in M. Lopez de Herrera Grant, Section 46, and on final test flowed 19,000,000 cu. ft. of gas per day through open tubing. Gas-oil ratio 68,000 to 1. Shut-in pressure was 4,190 lb. At 7,033-37 ft., this well tested some gas condensate. Total depth is 8,284 ft., with production through 62 perforations at 8,254-68 ft.

A new gas sand for Sarco Creek in Goliad County has been opened by Ginther, Warren & Ginther 3 Carrie G. Wood et al, in George Villa Survey, Abstract 49, 9 miles southeast of Goliad. Total depth is 5,105 ft., and well was dual completed with new sand perforated with 48 holes at 4,148-58 ft., with potential test 5,570,000 cu. ft. of gas per day through 3/16-in. choke. The Vicksburg regular field pay was perforated with 48 holes at 5,032-42 ft. and flowed a potential of 1,555,000 cu. ft. of gas per day through 3/16-in. choke. Estimated 50,000,000 cu. ft. per day open, rock pressure 2,035 lb., and estimated 70 bbl. of condensate, tubing pressure 1,935 lb.

In the Tanglewood area of Lee County, Humble Oil & Refining Co. 1 George Vick et al, wildcat in Bethel Smith Survey, is now drilling ahead from 6,470 ft. in shale and lime. This test flowed 1,000,000 cu. ft. of gas per day on 3/16-in. choke, tubing pressure 1,725 lb., and a trace of oil through perforations at 6,060-75 ft.

There were 32 new locations reported this week, 4 being wildcats, 1 each in Brooks, Nueces, Starr and Webb counties. Duval County received six new starts, Nueces County five, and Starr County four. Of the 22 completions reported, 6 are wildcats, 1 new gas pay in Goliad County, 1 new gas pool opener in Nueces County, and 4 dry holes, 1 each in Hidalgo, Kleberg, Lee, and Starr counties. Greatest activity was shown in Goliad, Jim Wells, Nueces, and Starr counties, each receiving three completions.

SUCCESSFUL WILDCATS SOUTHWEST TEXAS

Goliad County: New gas pay Sarco Creek field: Ginther, Warren & Ginther 3 Carrie G. Wood et al, Geo. Villa Sur., Abst. 49, 9 mi. SE of Goliad, TD 5,105 ft., dual completion, perf. 4,148-58 ft. (new pay), PT 5,570,000 cu. ft. gas day through 3/16-in. choke, estimated 46,500,000 cu. ft. gas day open, RP 1,715 lb., CP 1,635 lb.; perf. 5,032-42 ft., PT 1,555,000 cu. ft. gas day through 3/16-in. choke, estimated 50,000,000 cu. ft. day open, RP 2,035 lb., estimated 70 bbl. condensate, TP 1,935 lb.

Neuces County: New gas pool, North Minnie Bock — Atlantic Refining Co. 1 James H. Ewing, M. Lopez de Herrera Grant, Sec. 46, TD 8,284 ft., perf. 8,254-68 ft., PT 19,000,000 cu. ft. gas day open tubing, gas-oil ratio 68,000 to 1, shut-in pressure 4,190 lb., gravity 50°.

WILDCAT FAILURES SOUTHWEST TEXAS

Hidalgo County: La Gloria Corp. 1 North Weslaco Gas Unit 1, Sec. 145, dry, TD 9,880 ft.

Kleberg County: Humble 2 King Ranch, Santa Gertrudis Grant, 4½ mi. SW of Kingsville, dry, TD 7,557 ft.

Lee County: Seaboard Oil Co. of Dela. 1 Paul Hendrick, F. Potthast Sur., 8 mi. N of Paige, dry, TD 9,617 ft.

Starr County: Zimmerman & Brock 1 G. A. Guerra, Porcion 84, 6 mi. NE of Rio Grande City, dry, TD 2,029 ft.

SOUTH LOUISIANA

Magnolia Brings in New Field in Beauregard

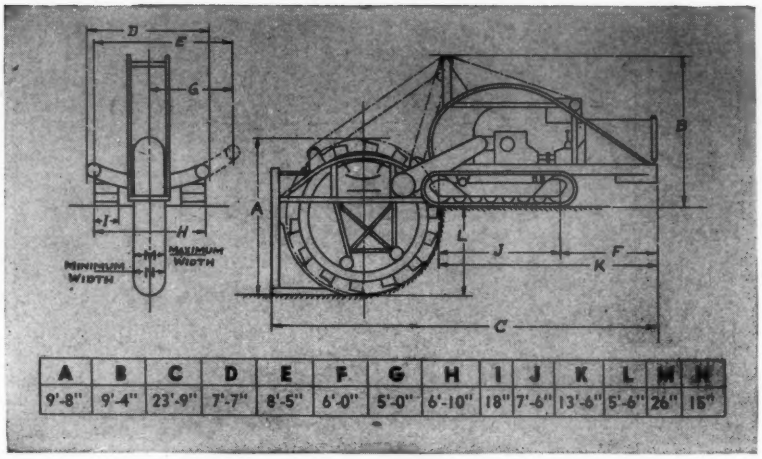
NEW ORLEANS.—A new producing field has been brought in by Magnolia Petroleum Co. at 2-C Lutcher-Moore Lumber Co., NE SE 22-5s-11w, about 4 miles west of West Pine Grove field and 12 miles northeast of Bancroft field, in Beauregard Parish. Originally planned to test the Wilcox, well was drilled to a depth of 11,618 ft.; however, operators completed in the Cockfield through perforations at 7,627-31 ft. On a drill-stem test with packer set at 7,618 ft. well flowed 175 bbl. of pipe-line oil daily through a ¼-in. and 7/64-in. chokes. Additional perforations were made from 7,638-42 ft., and the well is now shut in waiting on tank-storage space before running a conservation commission potential test.

The Oretta field, Beauregard Parish, has been extended 2 miles northeast by Magnolia 1 M. J. Witski, in SE NW 22-6s-11w. Well flowed between 75 to 100 bbl. of oil daily on drill-stem test through perforations at 8,422-26 ft., using ¼-in. and ⅛-in. chokes, with 1,450 lb. working pressure. Additional perforations were made at 8,431-35 ft., and tubing is being run for a flow test. Total depth is 8,969 ft., and 5½-in. casing is cemented at 8,700 ft.

In the Woodside area in St. Landry Parish, Crosby Drilling Corp. and Lyle Cummins 1 Eugene Gordon, SE SW 2-3s-6e, cored fine sand with some saturation and good odor from 9,205-25 ft. Top of the second sand was encountered at 9,250 ft., and sand, hard and fine with odor of oil and saturation, was recovered from 9,250-56 ft. When at a depth of 9,280 ft. electrical log was run and top of Wilcox was found at 9,210 ft. Operators plan to drill ahead to the 10,000-ft. level where another log will be run.

Barnsdall Oil Co. 1 M. M. Stafford Unit, deep test at West Tepetate field in Jefferson Davis Parish, 36-7s-3w, continues testing for new deep production. Total depth is 10,005 ft. with 5-in. liner from 9,285-10,005 ft. On initial test through 24 perforations at 9,894-9,902 ft. it flowed some 52°-gravity condensate through a 7/64-in. choke with 6,300 lb. pressure on the tubing, flowing, and 6,400 lb. shut in. These perforations were squeezed and new perforations made, then squeezed. Production packer was set at 9,423 ft. but failed to hold, and operators now are fishing.

All six new locations reported this week are in proven areas with Egan field receiving three. There were eight completions and all of these are in proven fields. Vinton field in Calcasieu Parish took the lead with two producers. Both Acadia and



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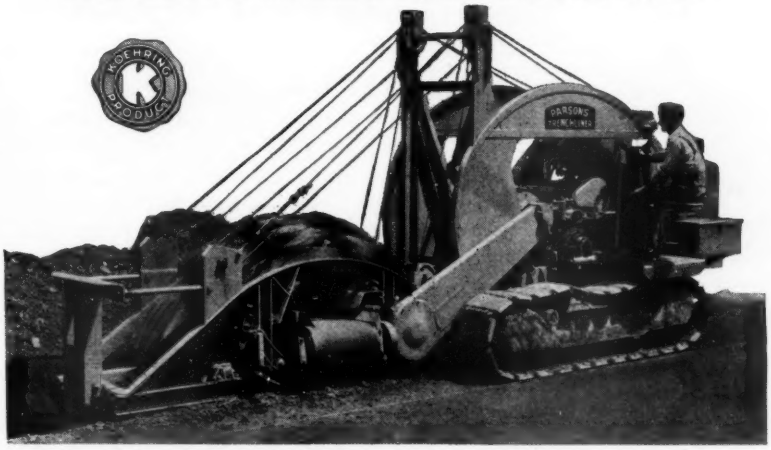

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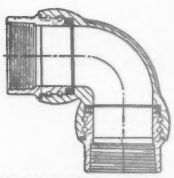

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Calcasieu parishes received two completions. No wildcat activity was reported.

CALIFORNIA

Navy Completes Commercial Test in Hillcrest Section

LOS ANGELES.—The Navy Department has completed a commercial producing well in the extreme western end of the Hillcrest section of Elk Hills Naval Petroleum Reserve and present indications are that a large part of the Hillcrest anticline will be found productive. If this proves to be the case, the Navy Department will have a reserve in California of the first magnitude. The new well, which is located in Section 24-30s-22e about 6 miles west of the older section of Elk Hills, is situated in about the center of Section 24 and is therefore approximately 2,640 ft. east of the west boundary of the Naval reserve. Section 23 to the west, Section 13 to the north, and Section 25 to the south, are owned in fee by Standard Oil Co. of California.

Completion of Navy's No. 44 in Section 24 is of special importance because the Navy has completed a Stevens sand producer in Section 29-30s-23e about 2 miles east of well No. 44 and between the latter and the older section of the Elk Hills field. Well No. 44 is a Scalez sand completion and was brought in on the beam from 2,795 ft. The Stevens sand completion was brought in flowing 525 bbl. daily from 5,726 ft. and definitely proves the existence of Stevens sand production in the Hillcrest section of the field.

The Stevens sand of Miocene age was found in the original section of Elk Hills below 11,000 ft. thus indicating a separate accumulation in the Hillcrest area.

Hopes for a rejuvenation of production in the Torrance field from a conglomerate or fractured schist were dissipated this week when Superior Oil Co. drilled its 66 Torrance into the basement and found a normal section devoid of a weathered and fractured schist. Operators were somewhat encouraged when Superior undertook to determine whether production could be developed in the schist conglomerate as a few wells have been finished in the Wilmington field from a conglomerate found below the base of the Ford sand and above the schist basement.

Possibility of developing similar production at Torrance appeared bright as there is an overlapping of the Ranger zone which might indicate a conglomerate or fractured schist zone. This schist-conglomerate production at Wilmington appears limited to a relatively small part of the field and a somewhat similar situation might exist at Torrance. In such a case the failure of Superior to find production in 66 Torrance would not necessarily preclude basement production elsewhere in the field.

Tide Water Associated Oil Co. has not yet concluded work on 154 Luck, a deep test in the extreme west end of the Kern River field. Drilling operations were concluded about 10 days ago with the well in the basement and work is now being done by a production crew with portable equipment. The well is situated in the most favorable section of the Kern River field as the formations thicken to the west.

Shell Oil Co., Inc., which has been making an extended production test on 48-A Alamitos, a deep test in the Long Beach field, has just about concluded that the zone being tested at 12,853-14,950 ft. is not commercially productive as the well is producing 18 bbl. of 27°-gravity oil cutting 25 per cent daily on gas lift. This deep well was carried down to the basement but the oil sand found does not have sufficient kick to flow naturally and is too tight to produce even on gas lift. Shell's other deep test at Long Beach, 1 Stakemiller-Rose, has

been plugged back from 12,381 ft. to 11,520 ft. and is producing from the Formax sand of probable Miocene age. Current production on beam is 46 bbl. of 27.2°-gravity oil cutting 16 per cent daily. Shell's most important test in Los Angeles Basin is 1 Dominguez Estate, approximately 1 mile east of the Dominguez field. This outpost has found a second sand at 10,478 ft. and plans are under way to make a formation test. A showing higher up in the hole was unproductive but may be tested again.

There was very little disparity between completions and locations for projected wells this week and whereas there has been a substantial decline since June of last year drilling operations appear to have reached an equilibrium. Exploitation of the fractured schist basement at Edison and combined exploration and exploitation work in the Cymric district appear to have arrested the decline in drilling that occurred late in 1945 and this together with a probable discovery of a new oil field in the Bandini district of Los Angeles Basin should stabilize drilling at present levels.

CALIFORNIA WILDCAT FAILURES

Kern County, Dagany Gap: Shell 2 U. C., 3-25s-18e, bottomed in gray sand, no formation or production tests made, only minor showings logged, TD 1,501 ft.

Grapevine: Richfield 1 Evans, 36-12n-19w, pumped small amount of oil that cut 80 per cent water, could not exclude water, not a commercial well, TD 5,043 ft.

McVann: Independent Exploration Co. 2 Lambert Lands, 35-26s-27e, bottomed in hard gray sand, Vedder sand of Miocene age at 2,913 ft. was barren, TD 2,945 ft.

Madera County, Chowchilla: Union 7 Gamble, 15-9s-16e, bottomed in basement, top granite 3,037 ft., no showings of importance, TD 3,085 ft.

ROCKY MOUNTAIN

Important Extension for Rangely Field Indicated

DENVER.—The outstanding development of the week in the Rocky Mountain area was the favorable indication of an important extension of the productive area of the Rangely field in western Colorado in Continental Oil Co. 1 Dorothy Rooth, C NW SW 15-2n-103w, an outpost 1½ miles northwest of the nearest producer. Drilling stopped at 6,596 ft. to run the 7-in. pipe which was set at 6,578 ft. A test of the cement then was made through the 3½-in. drill pipe. Open 21 minutes, there was a recovery of 195 ft. of oil and 175 ft. of mud. The top of the Weber was at 6,581 ft., and the test was made only 15 ft. in the sand. At last report mud was being mixed preliminary to drilling into the sand, the intention being to core the entire horizon. The ground elevation of the well is 5,602 ft., which puts the top of the Weber at 979 ft. below sea level. Since previous estimates generally have placed the probable productive area down to the —1,100-ft. contour, the importance of the test becomes apparent.

The limits of the Rangely field have not yet been determined in any direction, and none of the wells have been on production long enough to provide dependable figures on the ultimate recovery per acre. It has been generally agreed, however, that at least 21,000 acres would be productive, and estimates of ultimate recovery have ranged all the way from 10,000 to 20,000 bbl. per acre. If the Rooth well comes up to expectations as indicated in the first stages of completion, it is conservatively estimated that at least 4,000 acres will be added to the previous figures on reserves, and on the basis of 12,000 bbl. to the acre, amount to 49,000,000 bbl. increase. On the same basis, the completion of the Rooth well as a producer will bring the estimated area up to 25,000 acres, and the reserves at only 12,000 bbl. to the acre, up to 300,000,000 bbl. Salt Creek heretofore has held first place in the Rocky Mountain area, the second Wall Creek sand being productive over 20,500 acres, exclusive of Teapot Dome. The recovery from the second Wall Creek up to 1938 was 10,100 bbl. per acre.

Wilson Creek deep test.—Texas Co.-California Co. 20 Unit, NE SW NE 34-3n-94w, Wilson Creek field, western Colorado, which drilled to 12,702 ft., is making a swab test of the Weber sand which showed some saturation on the way down. This well, the deepest in Colorado, was a "tight" hole below the Sundance, the lowest producing horizon in the field, and although there were rumors of a showing in the Weber, the only official information regarding same was released this week. This was limited to the statement that the Weber was being tested at 8,200 to 9,400 ft., and that it swabbed 21 bbl. of brown oily water in 8 hours with diminishing gas and distillate.

Dakota test for Kutz Canyon.—Kutz Can-

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yon Oil & Gas Co. has signed a contract with Paul B. English, of Artesia, and Byrd-Frost, Inc., of Dallas, for a Dakota sand test in the Kutz Canyon gas field, a basinward structure in the San Juan basin, San Juan County, New Mexico, to be drilled this spring. The field has been producing gas from the Picture Cliff sand of upper Cretaceous age for the past 17 years, but the Dakota at around 6,000 ft. has never been drilled. Transcal Petroleum Corp. drilled 1 Davidson, NW NW 28-28-10w, last year to 5,750 ft., where the hole was lost and the contract with the Kutz Canyon company was surrendered. The new interests closed the deal after making torsion balance, gravity meter and seismograph surveys of the area and now are selecting the location for the test. They acquired half of the Kutz Canyon block of 12,000 acres and also have leased an additional 7,000 acres around the block. While the contract calls for a test to the Dakota, it may go to the Pennsylvanian.

River Dome wildcat in Tensleep.—Pure Oil Co. 1 Unit, NE NE NW 18-48n-92w, River Dome, Washakie County, Wyoming, topped the Tensleep sand at 10,241 ft., and drilled about 100 ft. of that formation and at last report was coring in or near the top of the Amsden at 10,350 ft. The best saturation and porosity was found near the top of the formation, the lower part being hard and tight. The most favorable zone was at 10,280-10,305 ft. No attempt to test was made due to the hazard involved at that depth. Only slight saturation was found in the Embar, which was encountered at 9,978 ft., the formation being very hard. Previously the well showed for 200 bbl. per day of distillate in the Muddy sand and considerable gas in the Frontier. A second well is being drilled to determine the full value of the upper discoveries.

New operations.—Thirteen new operations were reported, 2 in Colorado, 1 in Wyoming and 10 in Montana. Two of these were wildcats. The Colorado locations were in the Rangely district, one by Phillips Petroleum Co. and the other a wildcat 5 miles east of the nearest producer. The latter is to be drilled by John Brorphy, an operator in the Newcastle district in Wyoming, in C Lot 8 (NE SE) 33-2n-101w. It is a farm-out from Princeton & Terrell, owners of the lease. Current maps show the location lower on structure than Continental's Rooth well, a near completion on the west flank. The Wyoming location was in the Big Muddy field. The Montana locations included four in Cut Bank and three in Kevin-Sunburst. Cat Creek and Cedar Creek had one each. The wildcat is Pettie, Stewart-Inland 1 Downing, SE SW SW 30-37n-5w, North Cut Bank area.

Completions.—Completions were down to nine, of which three were oil wells, one was a gas well and five were dry holes. Four were wildcats, all dry. The oil wells were two in Kevin-Sunburst and one in Cut Bank.

COLORADO WILDCAT FAILURE

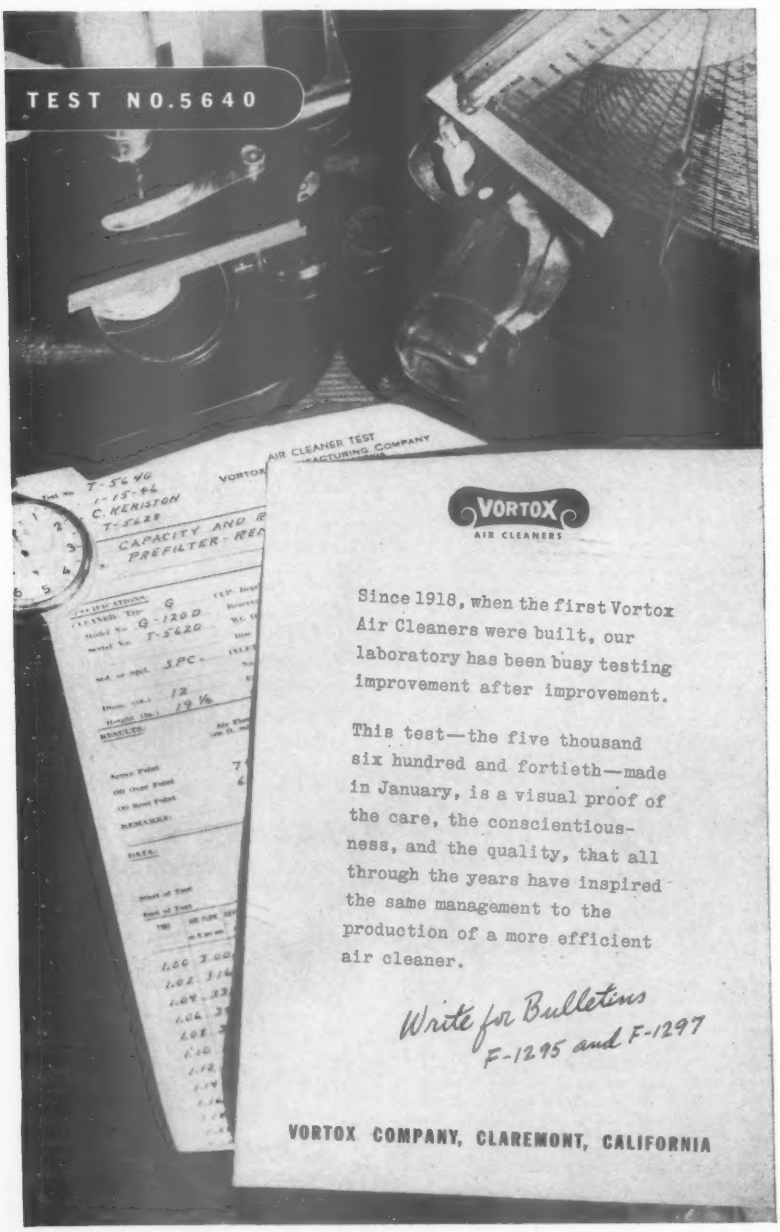
Johnstown, Weld County: Frontier Ref. Co. 1 Hankins, NE SE 22-5n-67w, dry at 8,350 ft. Electric survey tops: Niobrara 6,861 ft., Timpas-Codell 7,164-7,211 ft., Benton 7,211 ft., Greenhorn 7,416-52 ft., Dakota 7,626-7,718 ft., Lakota 7,869-7,982 ft., Morrison 7,982 ft., Sundance 8,262 ft.

WYOMING WILDCAT FAILURES

Crook's Gap, Fremont County: Sinclair-Wyoming Oil Co. 3 Unit, SE NE NE 13-28n-93w, dry at 8,733 ft., probably tested Tensleep, tops not released.

Garland, Big Horn-Park counties: Union Oil Co. 1 Stratham, NE NW Lot 59-E-56n-97w, dry at 3,890 ft. in Morrison, Dakota 3,410 ft., test in fault block on NE flank.

South Byron, Big Horn County: Taylor Oil Co. 1 Havig, SW NE 31-56n-96w, dry at 6,067 ft. in Madison, top Madison 6,015 ft.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CANADIAN FIELDS

North Turner Valley Test Has 124-Bbl. Initial

CHATHAM.—In North Turner Valley, Royalite-Lowery 4, LSD 13, 11-20-3w5, with Madison at 7,766-8,027 ft., has initial production of 124 bbl.

In the North-Central area, Royalite 85, LSD 3, 2-20-3w5, with Madison at 8,194-476 ft., perforated the upper porous to start production at 96 bbl. with booster gas, and is further acidizing and testing.

In the North Turner Valley extension, Foothills Oil & Gas 23, LSD 3, 9-21-3w5, east flank test, finished with Madison at 8,320-726 ft. and made 226 bbl. after initial acid treatments.

Crossfield.—In the Crossfield area, 20 miles north of Calgary, Imperial-Anglo Canadian 1, LSD 9, 11-28-2w5, got the Madison limestone unexpectedly at 8,177 ft. and is deepening after drill-stem tests at the contact failed to yield production.

Brazeau.—On the Brazeau structure in the central foothills of Alberta, Home-Brazeau 1, LSD 5, 17-43-17w5, is below 11,145 ft. and approaching the Madison limestone for the second time after faulting back to the Blairmore formation. The test is expected to get the limestone around 11,400 ft. and should go to around 11,800 ft. to test the two porous horizons if the limestone logs similarly to Turner Valley.

Nordegg.—In the Nordegg area, Central Foothills, Shunda 1, LSD 15, 36-40-15w5, is deepening after tests at 1,210 ft. showed traces of oil and some water.

Ram River.—On the Ram River-Clearwater structure, west of Rocky Mountain House, Ram River 3, LSD 12, 1-37-11w5, is redrilling to straighten hole which was found considerably off vertical. Ram River 4, LSD 9, 36-34-10w5, is below 270 ft. and nearing the Devonian limestone, the potential producing horizon.

Antelope Hills.—Two potential producing horizons are indicated in the Antelope Hills area in eastern Alberta close to the Saskatchewan boundary. Alliance 1, LSD 15, 19-20-1w4, obtained good showings in the Bow Island sand around 2,300 ft., which will be tested after the well, now below 3,600 ft., has been deepened into the underlying Devonian limestone, where major production is anticipated. Alliance 2 is being located.

Ontario.—In southwestern Ontario, Drake & Walker, drilling in Lot 53, Concession 5, Malden Township, in Essex County, have encountered a commercial gas flow, estimated 385,000 cu. ft., at 965 ft. Location is not far from Amherstburg, which is a potential market for the gas.

PERMIAN BASIN

New Pay Indicated For Penwell Pool

MIDLAND.—The Texas Co. 29 Connell, Section 9, Block B-16, Public School Land Survey, indicating a new pay for the Penwell pool of southwestern Ector County, perforated casing from 4,590-4,615 ft. in the Glorietta, and swabbed into the pits for 5 hours to clean out. Recovery showed 5 per cent acid water, 5 per cent emulsion and the balance oil. The test was swabbed into tanks for 7 hours, averaging 4 bbl. of fluid an hour, cut 25 per cent acid water and 75 per cent new oil. Operator was continuing to test. Phillips Petroleum Co. 1 Eidson, Section 25, Block B-15, Public School Land Survey ¾-mile west of the north end of the Penwell pool, having shown for production in the Glorietta, was drilling below 5,298 ft. in sandy lime.

Stanolind Oil & Gas Co. 1 Williamson, Section 5, Block 45, T-1-N, T&P Survey, wildcat northwest of the Goldsmith pool of northwestern Ector County, ran a 1-hour drill-stem test from 9,724-9,805 ft. Recovery was 65 ft. of drilling mud with no shows. Operator was drilling below 9,832 ft. in sand and shale. Stanolind 1 Kayser, Section 34, Block 43, T-2-S, T&P Survey, wildcat 5 miles southwest of Odessa, Ector County, was drilling below 9,680 ft. in lime and chert.

Stanolind 1 Mike Veretto, Labor 7, League 72, Val Verde County School Lands, Hockley County wildcat 2 miles west of Levelland, ran a 2-hour drill-stem test from 4,745-4,889 ft. There was gas in 40 minutes and 225 ft. of gas-cut mud and 390 ft. of oil and gas-cut drilling mud was recovered. Flowing pressure was 450 lb. Humble Oil & Refining Co. 1 Doss, Section 1, Block A-24, Public School Land Survey, 1 mile north outpost to the Doss pool, southwestern Gaines County, ran a 105-minute drill-stem test from 6,069-6,365 ft. and recovered 120 ft. of drilling mud, 1,120 ft. of oil and gas-cut drilling mud. It was coring below 6,380 ft.

Humble has staked two wildcats in West Texas, one in Andrews County and one in Sterling County. In western Andrews the company will drill 1 J. G. Gaines et al, 660 ft. from the north and east lines of Section 14, Block A-39, Public School Land Survey. It is scheduled to drill to 10,500 ft. It is 9 miles southeast of Eunice, in southeastern Lea County, New Mexico. The Sterling County wildcat, to be drilled to 9,500 ft., is 1 Lula C. Harris et al, 1,980 ft. from the north and west lines of Section 114, Block 6, H&TC Survey. The test is 12 miles west-southwest of Water Valley in Tom Green County.

Sharon Ridge field, Scurry County, reported five completions this week, and Fullerton field, Andrews County, and Keystone-Ellenburger field, Winkler County, had two each. Welch field, Dawson County, had four locations, Garza County three, and Todd Deep field, Crockett County, and North Ward-Estes field, Ward County, two each. Keystone-Ellenburger field has 37

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drilling wells; TXL field, Ector County, 33; Fullerton field, Andrews County, 30; Block 31 field, Crane County, 18; and Welch field, Dawson County, 14.

PANHANDLE WILDCAT FAILURE

Hartley County: Pure Oil Co. 1 Skalsky, T. B. Russell Sur., 2 mi. SE Hartley, elev. 3,900 ft., dry at 4,034 ft.

SOUTHEASTERN NEW MEXICO

HOBBS.—Magnolia Petroleum Co. 9 Argo-Brunson, 9-22s-37e, ¼-mile northeast of Neville G. Penrose, Inc., 1 Federal-Penrose, opener of the Eunice Ellenburger field of southeastern Lea County, has been completed to flow 1,236 bbl. of oil in 15 hours through perforations from 7,770-7,805 ft. Mid-Continent Petroleum Corp. 1 Christmas, 17-22s-37e, 1½ miles northwest of the Eunice Ellenburger discovery, has shut down for orders at 6,550 ft. in lower Permian lime. On a drill-stem test from 6,385-6,500 ft. there was a slight showing of gas with drilling mud.

Culberson & Irwin, Inc., of Midland, Tex., have staked a proposed 4,000-ft. wildcat for Seven Rivers production 3 miles northwest of the West Eunice field in south central Lea. Humble Oil & Refining Co. 1 Cooper, 23-24s-36e, depleted shallow well in the Cooper Jal field of southeastern Lea which is being deepened, recovered 460 ft. of drilling mud and 1,000 ft. of salt water on a 2-hour drill-stem test from 6,970-7,177 ft. in Permian lime. It was waiting on orders.

Empire and Grayburg-Jackson fields, Eddy County, and Paddock and West Roberts field, Lea County, each reported one completion. Russell field, Eddy County, Langlie-Mattix, Paddock and Penrose-Skelly fields, Lea County, each had one location. Eddy County has 32 active drilling wells with 8 wildcats and Lea County has 40 with 7 wildcats.

SOUTHEASTERN NEW MEXICO SUCCESSFUL WILDCAT

Eddy County: Extension to old oil pool—Forest E. Levers 1-B Levers, 34-16s-29e, S of High Lonesome field, elev. 3,661 ft., flowed 63 bbl. day, perf. 2,630-75 ft. Grayburg, gravity 39°, TD 3,028 ft.

SOUTHEASTERN NEW MEXICO WILDCAT FAILURE

Chaves County: Richfield Oil Co. 1 Federal-Lillian Cole, 18-11s-27e, 4 mi. E Comanche field, elev. 3,673 ft., Devonian 6,240 ft., Dacite 6,618 ft., dry at 6,630 ft.

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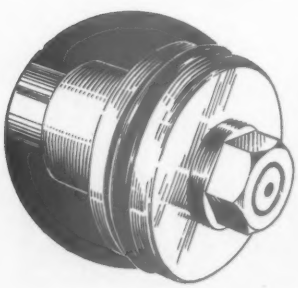

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ILLINOIS

Clay City Field Extended Two Miles Eastward

MATTOON.—The Clay City Consolidated field was extended 2 miles to the east during the past week with the completion of Olson Drilling Co. 1 K. B. Wilson, SE SE NE 26-2n-8e, Wayne County. The 1 Wilson was completed in the Lower O'Hara lime at 3,031-36 ft., and the Rosiclare lime at 3,056-59 ft., total depth 3,060 ft. It swabbed and flowed 700 bbl. of oil in the first seven hours following an acid treatment of 5,000 gal.

Production in the Mattoon field of Coles County is continuing its steady increase and last week reached the 9,000-bbl. mark. The field now has 143 producing wells and 2 shut-in gas wells. Current operations total 83, of which 18 are drilling wells, 4 are locations, and the remainder are in various stages of completion. This field is the most active spot in the Illinois Basin, accounting for a very large percentage of the total number of operations now under way.

Another active spot in Illinois is the Ingraham West pool of Clay County. This pool is now producing from three pay zones, the Cypress sand at about 2,575 ft., the Benoist sand at about 2,700 ft., and the McClosky lime at 2,850 ft. Recent wells in this area have been completed for as much as 1,000 bbl. of oil daily.

Completions during the past week added 19 oil wells and 9 dry holes to the Basin fields. Five of these were wildcats, all dry. Of the 40 new operations reported, 12 were in the Mattoon area of Coles County. Five new wildcats were reported, one each for Effingham, Richland, Lawrence, Clinton and Hamilton counties.

ILLINOIS WILDCAT FAILURES

Clinton County: H. J. Schlafley 1 Merten, SW NW NW 33-2n-1w, dry at 1,656 ft., Glen Dean 1,097 ft., Hardinsburg sand 1,128 ft., Golconda 1,164 ft., Barlow 1,237 ft., Cypress sand 1,314 ft., Benoist 1,421 ft., Aux Vases sand 1,478 ft., Ste. Genevieve 1,560 ft., Fredonia 1,586 ft.

Coles County: Hageman & Pond 1 Cramer, SE SE SE 35-13n-7e, dry at 2,000 ft.

Hamilton County: Dale Hopkins 1 J. Schearman, NE SW SW 2-6s-7e, dry at 3,482 ft., Menard 2,475 ft., Glen Dean 2,690 ft., Golconda 2,833 ft., Barlow 2,945 ft., Cypress sand 3,017 ft., Benoist 3,181 ft., Renault 3,264 ft., Aux Vases sand 3,289 ft., Ste. Genevieve 3,349 ft., McClosky, 3,426 ft.

Jasper County: John Washburn et al 2 S. J. Baker, E½ NW SE 30-6n-10e, dry at 2,966 ft., Glen Dean 2,326 ft., Golconda 2,392 ft., Barlow 2,474 ft., Renault 2,764 ft., Ste. Genevieve 2,836 ft., Fredonia 2,865 ft.

Jefferson County: E. S. Adkins 1 J. Green, NW SW SW 8-3s-1e, dry at 2,370 ft., Menard 1,356 ft., Glen Dean 1,576 ft., Barlow 1,797 ft., Cypress sand 1,808 ft.,

Paint Creek 1,868 ft., Benoist sand 1,963 ft., Renault 2,015 ft., Aux Vases sand 2,048 ft., Ste. Genevieve 2,141 ft., Rosiclare sand 2,162 ft., Fredonia 2,220 ft.

OHIO, KENTUCKY

Perry County Tests May Bring Further Drilling

COLUMBUS. — In southeastern Hopewell Township, Perry County, two wells have been drilled which will call for additional drilling. Industrial Gas 1 R. B. Skinner, Sec. 24, flowed 183 bbl. first 24 hours after shot. Clinton sand was found at 3,054-3,099 ft. One mile to the south, in Sec. 25, John Morrow 1 Lola Coulter, was drilled in with 2,000,000 cu. ft. gas in the top of the Clinton and a good show of oil in the bottom.

While drilling for Medina sand oil in Salt Creek Township, Muskingum County, B. G. Bartley 1 C. J. Massey, Sec. 35, encountered 2,400,000 cu. ft. with a rock pressure of 1,250 lb. in the first 7 ft. of Clinton sand. Top of sand 4,304 ft. and drilled to 4,320 ft.

Obermiller-Brendel 1 Disomi Consolidation, Sec. 32, Plain Township, Stark County, gaged 4,287,000 cu. ft. natural from Red Clinton and White Clinton at 4,497-4,561 ft. The well had the largest natural open flow of the recent wells completed in the North Canton area.

Stewart Field had seven new locations with five in the Bedford Berea pool. Ashland Field had six completions and Cambridge five.

OHIO SUCCESSFUL WILDCAT

Columbiana County, Madison Township: Ohio Oil-Galey 1 G. L. Powell, Sec. 22, Oriskany 4,465, 2,840,000 cu. ft., R. P. 1,750 lb., TD 4,473 ft.

WESTERN KENTUCKY

OWENSBORO. — A new oil field was opened in Western Kentucky during the past week with the completion of Joe Engberg 1 Blake Bros. 22-P-20, Union County wildcat. The 1 Blake Bros. was completed for about 50 bbl. of oil daily from the McClosky at 2,576-79 ft., total depth 2,579 ft. It is located about 1 mile southwest of Robinsonville.

Meanwhile, O. Blankenburg et al are waiting on cement with casing set to test a show of oil in the McClosky at the 1 F. W. Vogel, 12-P-23, Henderson County wildcat. The McClosky was found at 2,484-89 ft., and a 1-hour drill-stem test at that depth recovered 3 ft. of oil and 270 ft. of mud and salt water.

In Daviess County Callas-Asdell et al 1 Simon Smith, NW NW NW 14-P-29, is drilling below 1,640 ft. A show of oil was encountered in the Waltersburg sand at 1,062-72 ft., but no test was made.

Completions in Western Kentucky for the past week were three gas wells, four oil wells and two dry holes. All the gas wells and one of the oil wells were in the new Dixie pool of Henderson County. Six new tests were announced during the week, including one wildcat in Butler County, Perry Fulk 1 Chas. Belcher, 21-I-32, which is now shut down at 437 ft.

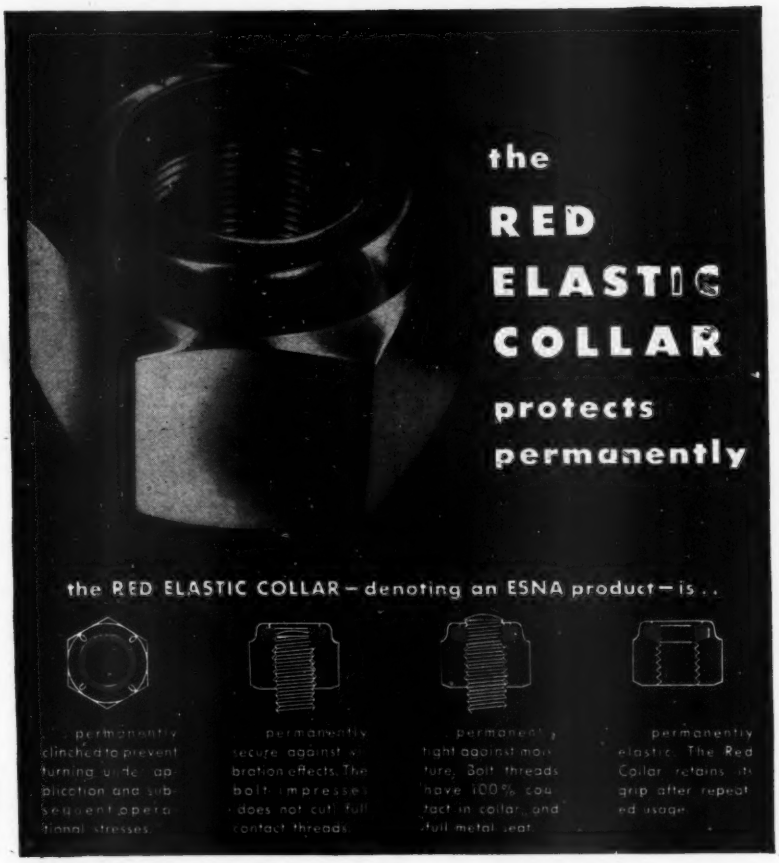
WESTERN KENTUCKY SUCCESSFUL WILDCAT

Union County: Joe Engberg 1 Blake Bros., 22-P-20, 1 mile SW Robinsonville, elev. 385 ft., pumped 50 bbl., McClosky 2,576-79 ft., TD 2,579 ft.

WESTERN KENTUCKY WILDCAT FAILURES

Grayson County: E. E. Alspach 1 Judson Fentress, 11-N-36, dry at 249 ft.

Muhlenberg County: B. Hackbusch et al 2 S. Yunker, 15-J-30, 3 miles E. Central City, elev. 484 ft., dry at 2,187 ft.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INDIANA

EVANSVILLE.—A new field is in prospect in Gibson County, where C. E. Skiles 1 Stein, SE SW SE 35-1s-12w, recovered 10 ft. of oil, 50 ft. of mud, and 400 ft. of gas, with no water, on a 1-hour drill-stem test of the Rosiclare at 2,306-09 ft. A show of gas was also encountered in the Benoist at 2,122-38 ft. Operators are now coring in the McClosky at about 2,250 ft. Elevation of the well is 395 ft.

Another Gibson County wildcat, J. C. Haynes and Olds Oil Co. 1 A. W. Warnick, NE NE SE 6-2s-10w, showed some favorable prospects when it encountered a show of gas in the Pennsylvanian sand at 625-27 ft. However, operators are drilling ahead and at present are at about 844 ft.

Two oil wells and two dry holes were completed in Indiana during the past week. The oil wells were in the North Owensville and Mt. Carmel East fields. Six new operations were reported and drilling permits were issued for four additional tests. Four of the new operations were in Gibson County and two were in Posey County. All drilling permits issued were for tests in Gibson County.

MICHIGAN

Small Boom Under Way In Gratiot County

SAGINAW.—A small drilling boom is under way in Elba Township, Gratiot County, as a result of Arthur E. Williams' results with his 1 Kral in Section 15. Six new tests, all but one of them offsets, have started. Williams has five of them, Charles W. Teater the other.

Eleven completions, 16 new locations, are reported for the week, the 6 producers including 3 more big wells in the Deep River field, Arenac County, where two other tests were dry. Wildcatting again failed of results, the three tests so classed being dry and including one in Michigan's far-north country—Schoolcraft County.

Of the 16 new locations, 1 is in Saginaw County, 1 in Osceola, 2 each in Bay, Arenac, Kent, and Missaukee.

MICHIGAN WILDCAT FAILURES

Isabella County, Deerfield Township: Charles W. Teater 1 Stella Grewe et al, SW NE NW 14-14e-5w, dry in Dundee formation, TD 3,716 ft.

Lapeer County, Oregon Township: Guy E. Dodge 1 Lee L. Woodward, SW NW NE 8-8n-9e, dry in Dundee, TD 2,371 ft.

Schoolcraft County, Hiawatha Township: Carl E. Christensen 1 fee, NE SW SE 13-42n-16w, dry in Richmond, TD 557 ft.

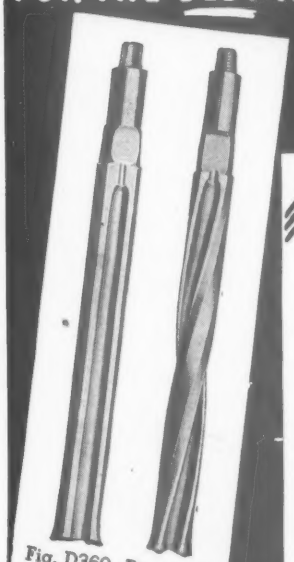

Fig. D360 Fig. D368

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EASTERN TEXAS

New Oil Pool Opened In Carthage County

DALLAS.—Placid Oil Co. 1 Allison, Isaac Hall Survey, on the north end of the Carthage gas-distillate field of Carthage County, has been completed to flow 168 bbl. of 42.6°-gravity oil through ¼-in. tubing choke on official test through perforations from 6,388-6,400 ft. in the Travis Peak, opening a new oil pool. The well will be dually completed. It will be completed for gas production in the Pettit zone. Humble Oil & Refining Co. 1 Pickering Lumber Co., Francois Survey, wildcat in the Huxley area of Shelby County, has been plugged back to 9,350 ft. The drill pipe stuck at 12,221 ft. Having failed to dislodge the pipe after 3 weeks' effort, operator will test the Travis Peak section where a gas show was logged.

American Liberty Oil Co. 1 Houston County Timber Co., A. Henry Survey, Trinity County wildcat in the Apple Springs sector, is dry at 8,345 ft. Three drill-stem tests were made from 8,080-8,334 ft. Recovery was salt water with a small amount of gas-cut drilling mud. Fred M. Manning, Inc., 1 Houston County Timber Co., Mirando Survey, 4 miles southeast of Weches, Houston County, is dry at 6,718 ft. in the Georgetown lime which was topped at 6,555 ft. The test has a small showing of oil and gas in the Woodbine from 6,030-38 ft. in cores, but drill-stem test of the section showed salt water.

Delta Drilling Co. 1 Livingston, Nacogdoches University Survey, wildcat 3 miles southeast of Reilly Springs, southern Hopkins County, was waiting on orders after drill-stem test from 8,005-32 ft. recovered mostly salt water with a small amount of gas.

Hawkins field, Wood County, and Carthage field, Panola County, each had two completions this week. Hawkins field had four locations and Lone Star field, Cherokee County, Wortham field, Freestone County, Waskom field, Harrison County, each had one. Carthage field has 30 active drilling wells, Hawkins field has 22 and Pickton field, Hopkins County, has 8.

EASTERN TEXAS WILDCAT FAILURES

Morris County: Hunt Oil Co. 1 Carleton Robinson, John Brandon Sur., 2½ mi. NE Daingerfield, elev. 432 ft., Paluxy 5,588 ft., Travis Peak 8,215 ft., dry at 8,430 ft.

Red River County: H. W. Snowden and H. C. Owens 1 Southern Pine Lbr. Co., Samuel Dew Sur., 12 mi. NW Clarksville, elev. 429 ft., Paluxy 1,350 ft., dry at 2,606 ft.

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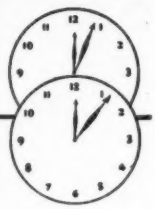

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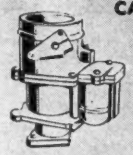

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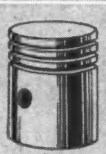
SPARK PLUGS—Solvent "26" safely cleans porcelain; helps loosen carbon deposits.

METAL PLATES AND SCREENS—Solvent "26" restores clear, clean finish to any metal surface.

DIES AND STAMPING—Solvent "26" removes drawing compounds from die-formed or stamped metal.

LABORATORY EQUIPMENT—Solvent "26" frees glass and metal tubing and their supports of gums, varnishes and other deposits or incrustations.



PISTONS—Removes lacquers, gums, resins, etc., from gas, gasolene and diesel engine pistons and rings. Also effective for cleaning all parts of dismantled motors, engines and machinery.

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OKLAHOMA

Logan County Outpost May Be New Wilcox Discovery

AT the close of the week operators were waiting on cement with pipe set to test saturated zones in both the first and second Wilcox sands at Logan County's newest prospect, Sinclair Prairie et al 1 Teuscher, SE SE SW 34-15n-1w. The Teuscher is 3 miles north of the Northeast Arcadia pool and some observers believe it may have found the "big end" of this pool. It is a community effort operated by seven companies and individuals.

First Wilcox was topped at 5,800 ft. and a core from 5,804-17 ft. recovered 10 ft. of sandy dolomite, of which the top 3 ft. was saturated. A core from 5,822-38 ft. recovered 14 ft. of saturated first Wilcox sand. Top of the second Wilcox has not been determined, but a core from 5,929-33 ft. recovered 4 ft. of saturated second Wilcox sand.

Correlated with the nearest well in the Arcadia pool, the Teuscher well was low on upper markers, but high on the Wilcox. It was approximately 100 ft. low on the Mississippi and 32 ft. low on the Oswego, but the Viola, at 4,047 ft., was about 27 ft. high. Although the Wilcox tops have not been officially called, they are apparently nearly 14 ft. higher in the Teuscher than in the Arcadia pool.

Gregory gas area.—Existence of a possible new oil field in the Gregory gas area was indicated last week by oil showings found in a new gas well just completed there. The Public Service Co. of Oklahoma 1 Rose, NW SE 28-10n-12e, encountered the Gilcrease sand at 2,355-60 ft. and set 5-in. pipe at 2,353 ft. After plug was drilled, the well showed for 2,500,000 cu. ft. of gas and a spray of oil. When the well was cleaned out, the gas actually measured 2,500,000 cu. ft. Field men estimated the oil spray at 1 to 2 bbl. an hour.

The Public Service Co. has a definite market for the gas, but no arrangements were made for the oil. Only the gas zone will be allowed to produce, therefore, and future plans will be made to test the oil zones. Further development may reveal that a good oil field exists in the Gregory gas area, which is located east of Weleetka, in extreme eastern Okfuskee County.

New Calvin sand area.—J. W. Sorrels is apparently opening a new Calvin sand pool for Seminole County at his 1 Swan, SW NE NE 36-7n-5e, south of the Hazel pool. In the pay from 2,505-50 ft. the well was drilled in flowing 95 bbl. of oil through open tubing. Location has been staked for 2 Swan in NE SW NE 36-7n-5e.

One of Oklahoma's most interesting wildcats at the present time is the Globe Oil & Refining Co. and Vickers Petroleum Co. 1 Gibson, SE NE 30-3n-2w, southwest of Antioch in Garvin County. It was reported as testing in the basal Pennsylvania sand at the close of the week, after getting only a show of mud in the upper Simpson. Originally, on a drill-stem test of the Pennsylvanian, the well flowed oil and gas, but hole was carried deeper.

The densest drilling campaign Oklahoma has witnessed in many years is now in full swing in the Cement townsite, Caddo County. One-fourth of a 100-well program planned by H. W. Snowden et al is under way with the wells either designated, drilling or completed. Snowden et al have completed five oil wells and three gas wells on the platted town or on city property and have 14 rigs running, plus one other in another part of the field. Two wells are still locations.

The corporation commission retains jurisdiction over completion and production of the townsite wells, but the Cement government regulates the spacing. The town has been divided into 40-acre units, and one well may be drilled to each of the various producing zones on each unit. Five separate pays are productive in the field, although a well recently completed reported a dozen or more possible pay zones.

A review of Oklahoma wildcat activity reveals that eight discoveries were completed during the month of January, six oil wells and two gas wells. One of the oil wells was a new producing zone, the Misener sand, in the North Steadman pool of Pontotoc County. Twenty-eight other wildcats were completed as dry holes, which gave the state a wildcatting success ratio of exactly 20 per cent for the month.

OKLAHOMA WILDCAT FAILURES

Garfield County: Sun et al 1 Christie, NE NW 28-24n-7w, dry, TD 6,937 ft., second Wilcox 6,915 ft.

Noble County: Olson Drilling 1 Smith, SW SW SE 2-22n-2w, dry, TD 5,253 ft., second Wilcox 5,238 ft.

Osage County: Norbla et al 1 SE NE NW 6-23n-6e, dry, TD 3,121 ft., Mississippi 3,114 ft.

LA.-ARK.

Rapides Parish Prospect Drilling Ahead

SHREVEPORT.—Union Producing Co. et al 1 Belgard, NW 14-4n-3w, which was reported to have some prospects in the Marine Tuscaloosa, was coring ahead at the end of the week with no additional shows encountered. An electrical survey was run at 9,802 ft., but exact findings have not been disclosed. A core from 9,812-23 ft. recovered 11 ft. of hard sand with no shows and a core from 9,823-40 ft. recovered 7 ft. of hard sand with no shows. Another core, taken at 9,840-50 ft., recovered 4 ft. of limestone and shale with no shows. Operators are now coring below 9,855 ft. in limestone.

Carter Oil Co. 1 Powell "C," in 33-16s-18w, has been completed as the first oil well in the Salem-Church field, Union County, Arkansas. It flowed 61 bbl. of oil in 14 hours through 7/64-in. choke. Production is from open hole at 7,055-64 ft., total depth 7,064 ft. in the Smackover.

NORTH LOUISIANA WILDCAT FAILURES

Franklin Parish: C. L. Smith 1 T. W. Starks, SE SW 26-13n-7e, dry, TD 7,245 ft.

Sabine Parish: Carter 1 Pickering L. Co., 610 ft. north and 660 ft. west of SE corner of SE SW 14-4n-11w, dry, TD 9,497 ft.

Tensas Parish: Spartan Drilling Co. 1 B. F. Thigpan, 660 ft. south and west of NE corner of NW of 29-12n-11w, dry, TD 9,178 ft.

Storm Delays Testing of South Dakota Wildcat

Winter storms during the past week delayed the testing of R. L. Hollingsworth et al's wildcat in Section 23-8s-2e, Fall River County, South Dakota. Operators had planned to test, but were unable to start running casing until the latter part of the week. The 5½-in. casing was run to 2,350 ft. where it was cemented with 100 sacks. Spudder will be moved in and the hole bailed as soon as possible. After drilling plug, Hollingsworth will test a lower sand zone at 2,295-2,330 ft. and then perforate opposite an upper zone at 2,195-2,223 ft. Total depth of the hole is 2,484 ft. and an electric survey indicated saturation through 105 ft. of a 156-ft. zone.

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The test is in an area which lies along the southwestern flank of the Black Hills and in the north end of the Denver Basin. The sands encountered are believed to check geologically with the Minnelusa section of the Pennsylvanian, and are probably equivalent in geological age to the sands producing in the Lance Creek field in Niobrara County, Wyoming.

MISSISSIPPI

Adams County Wildcat May Open New Oil Pool

JACKSON.—An oil sand at 10,080-94 ft., following a showing of gas-condensate and oil at 10,024-73 ft., improved prospects this week for a new Mississippi pool discovery. The showing came from Phillips Petroleum Co. 1 Davey, 46-8n-2w, near the Lake St. John pool of Adams County. Porous sand with gas-condensate at top and oil from the bottom at 10,024-73 ft. and salt water sand at 10,094-10,110 ft. was indicated by an electrical survey. Operators perforated and squeezed below and above the lower oil zone. Preparations are being made to perforate at 10,080-85 ft. and test.

Adams County's other prospect, Roeser & Pendleton-Sohio 1 Baker-Maier, 34-6n-2w, continued to encounter difficulty in shutting off water during the past week. Perforated at 10,547-52 ft. with 30 shots, a test was taken with packer set at 10,495 ft. which was allowed to flow for 18 hours. At the end of this period the well was flowing approximately 25 per cent oil and 75 per cent per cent water. The perforations were then squeezed and a test indicated that the cement was holding. Casing has been reperforated at 10,442-47 ft. with 40 shots, and testing of this interval is now in progress.

MISSISSIPPI WILDCAT FAILURES

Jones County: Premier Oil Refining 1 J. W. McKinley, 690 ft. north and 390 ft. east of SW corner NW SW of 26-9n-12w, dry, TD 7,706 ft., Massive sand 7,549 ft.

Perry County: Stanolind 1 Masonite Corp., SW NE of 7-3n-9w, dry, TD 9,044 ft., Massive sand 8,760 ft.

FLORIDA WILDCAT FAILURE

Highlands County: Humble 1 G. C. Carlton Estate, SW NE 34-38s-29e, dry, TD 12,985 ft.

KANSAS

Preparations Under Way To Test Kingman Wildcat

CITIES SERVICE OIL CO. is preparing to test through perforations both the Lansing and Kansas City lime formations at the 1 Kincaid, a rank wildcat in SW SE SW 8-29s-5w, Kingman County. The Kincaid is about 20 miles north of production in the Clearwater oil pool of Sedgwick County. It was drilled to a total depth of 4,525 ft. in the Arbuckle and topped the Lansing at 3,100 ft. and the Kansas City at 3,448 ft. No shows were logged at the lower levels but slight shows of oil and gas were found at 3,576-88 ft. in the Kansas City. Pipe was set at 3,696 ft.

The discovery well ot the Palco Townsite pool, Keys Drilling Co. 1 Neil, NL NE NE 20-9s-20w, Rooks County, was officially completed last week with a pump potential of 211 bbl. of oil daily. The well has been in the process of completion for several weeks during which the operator gave the well three treatments of acid. Production is from the Arbuckle lime at a total depth of 3,865 ft. The new pool is located ½ mile north of the town of Palco and 3 miles north of production in the Palco pool.

The Biddle pool of Cowley County was extended slightly to the east during the past week by Gralapp et al 1 Deichman, NE SE NW 23-31s-4e. Total depth is 2,971 ft. with pipe set at 2,939 ft. in the Bartlesville. Following an 80-qt. shot, the well flowed at the rate of 16 bbl. of oil an hour. Operators are testing at the present time.

Stanolind Oil Co. may have opened a new oil pool in Meade County with the 1 Adams, SW SW SW 7-35s-29w. The well was perforated at 6,018-40 ft. and, following an acid treatment, pumped 5 bbl. of oil and 2½ bbl. of water in the first 24-hour test. The 1 Adams is just north of the Oklahoma Panhandle and is more than 60 miles from the nearest oil production. It is about 6 miles from the Adams Ranch gas pool.

KANSAS SUCCESSFUL WILDCAT

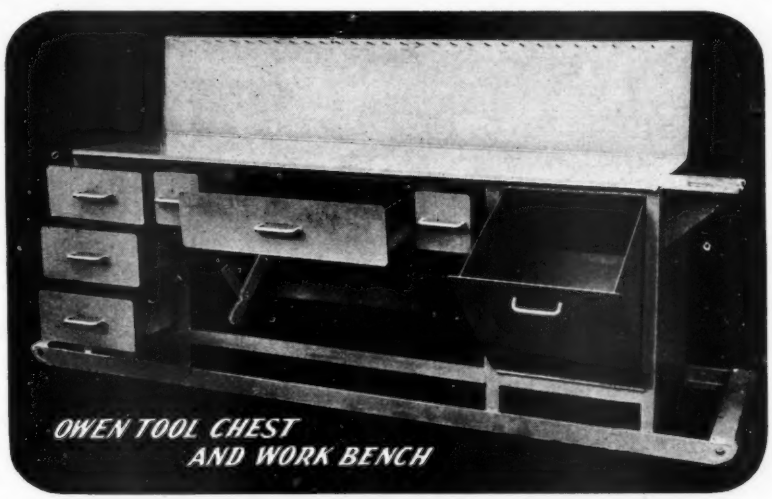
Finney County: New gas field—Wood River Oil Co. 1 Stechlejohn, NW SE 6-26s-32w, 7,900,000 cu. ft. of gas from Permian at 2,539-2,668 ft., TD 2,668 ft., Krieder 2,607-246 ft., Winfield 2,639 ft., Permian 2,539-2,668 ft.

KANSAS WILDCAT FAILURES

Butler County: J. E. Morris 1 Steel, NW NW SW 26-25-4e, dry, TD 2,612 ft., Viola 2,610 ft.

Gray County: Skelly 1 Hartnett, SE SE SE 8-25-27w, dry, TD 5,804 ft., Arbuckle 5,634 ft.

Woodson County: M. J. Trott and D. M. Milliken 1 Hoffmaster, NE NE NW 30-25-16e, dry, TD 2,078 ft., Arbuckle 1,710 ft.



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Rain guard above each drawer.
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SPECIFICATIONS:

Length of skids	10'
Length of bench	8'
Width of bench	30"
Height, front	32"
Height, back	4' 6"

DRAWER DIMENSIONS:

	Width	Length	Depth
Three on right	16"	24"	6"
Large center drawer	30"	24"	6"
Two, each side of center drawer	6"	24"	6"
Rag bin	20"	24"	24"

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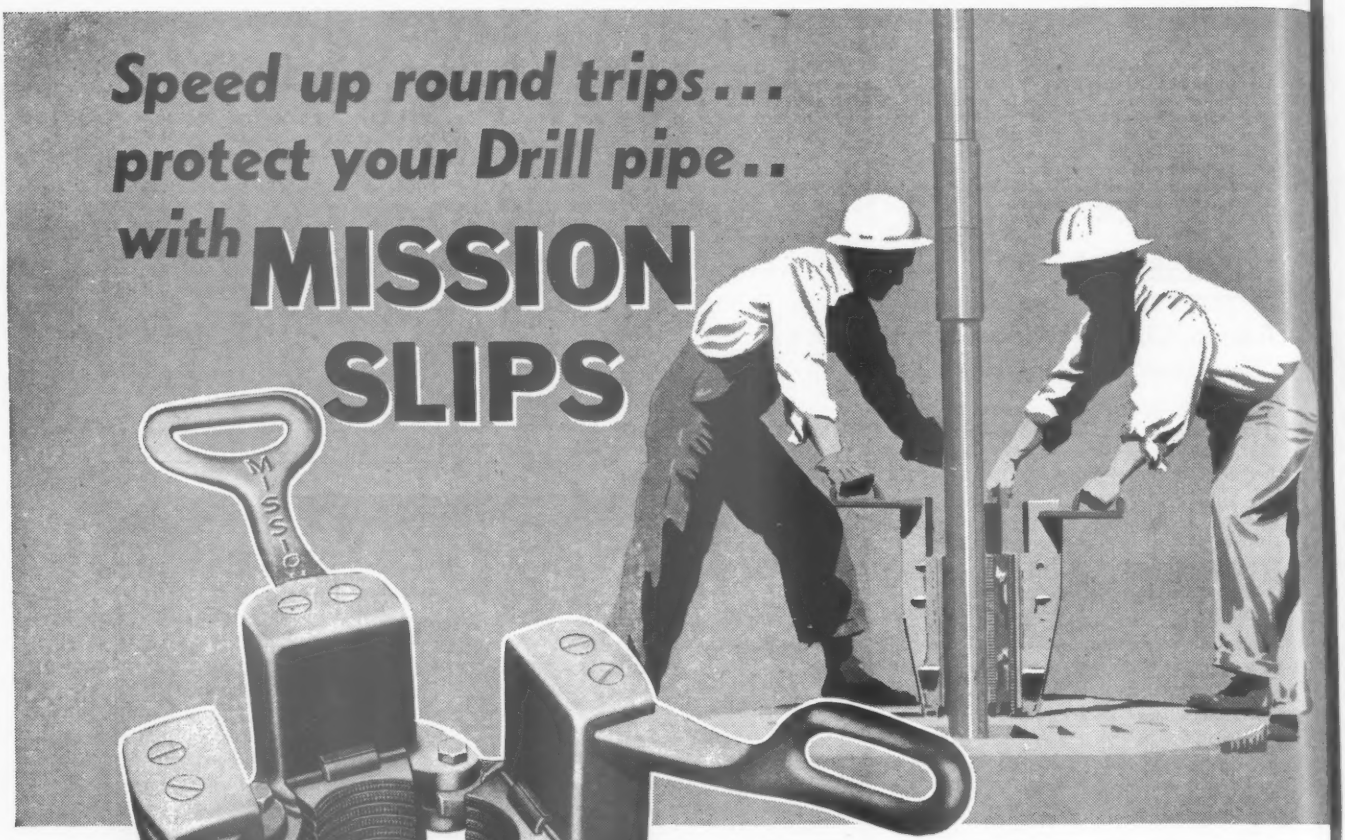

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5A–11

International Representatives of Jersey Company Study Lubrication

NEW YORK.—A 12-day international conference, with the emphasis on lubrication, has just been concluded here by 94 representatives —33 of whom were from foreign countries—of the Standard Oil Co. (New Jersey).

Officials from Jersey subsidiaries in Europe, North Africa, Latin America and the United States were in attendance for the 10 technical sessions. Among subjects discussed at the lube conference were: Manufacturing methods; foreign lubricating manufacturing facilities; industrial lubricants and miscellaneous products, and sales engineering and merchandising. A visit to Jersey's Bayway refinery and research laboratories there was a highlight of the 12-day conference.

Visitors from overseas, broken down into areas, were as follows:

Europe and North Africa: R. Anderson, director, and J. R. Botte, lube sales coordinator of Standard American Petroleum Co., S.A., Antwerp, Belgium; H. J. Bos, manager of wholesale lube department, Standard Amerikaansche Petroleum Compagnie, N.V., The Hague, Netherlands; J. L. N. Pollack, director, C Chilvers, technical manager, and David S. Paul, industrial sales manager, Anglo American Oil Co., Ltd., London; Bjoern Figenbaum, director of A/S Ostlandske Petroleumcampagnie, Oslo, Norway; Andre de Fontjoyeuse, lube oil sales manager of Standard Oil Co. of Morocco, Casablanca; Alix Moisan, lube sales engineer of Compagnie Algerienne des Petroles Standard, Algiers; G. Karlbom, lube engineer of Svenska Petroleum Aktiebolaget Standard, Stockholm, Sweden; Ignacio Macaya, manager of Macaya Co., Ltd. (agent), Madrid, Spain; Robert de Massey, lube oil sales manager of Standard Francaise des Petroles, Paris; A. C. Roebel, sales manager of Standard Mineraloelprodukte A. G., Zurich, Switzerland, and Harald Staehr, lube manager of Det Danske Petroleum Aktienselskab, Copenhagen.

The 13 delegates from Latin America were: L. Mariti, lube manager, and J. B. Crutchfield, lube engineer of Standard Oil Co. of Brazil, Rio de Janeiro; Osvaldo Corradi, general marketing assistant, and Rodolfo Esquivar, lube and aviation assistant, Creole Petroleum Corp., Caracas, Venezuela; Hernan Besa, lube oil coordinator of Standard Oil Co. of Chile, S.A.C., Santiago, Chile; W. L. Cuthbert, lube sales engineer of Esso Standard (Antilles) S.A., Port of Spain, Trinidad; Martin S. Henry, lube coordinator of West India Oil Co., Buenos Aires, Argentina; W. J. Leach, lube coordinator, Tropical Oil Co., Bogota, Colombia; Robert Motion, lube sales engineer of Esso Standard Oil (Caribbean) S.A., Havana; Thomas Newman, lube sales engineer, Esso Standard Oil (Central America) S.A., Panama; Oscar J. Plenge, lube coordinator, International Petroleum Co., Ltd., Lima, Peru; and Reinaldo Royo, industrial assistant, Standard Oil Co. of Puerto Rico, San Juan.

The six Canadian delegates were: R. B. Bennett, lube coordinator, and J. P. Jones from C. S. Wilcox's office, International Petroleum Co., Ltd., Toronto; L. V. Love, lube coordinator, C. E. Tilston, lube sales manager, R. H. Tanner, lube sales engineer, and H. H. Wilson, manufacturing chairman on standards committee, all from Imperial Oil Co., Toronto.

E. E. Soubry, foreign marketing ocordinator for Jersey's parent company, was chairman. Several parent company officials participated.

Gas Sales Expected to Follow Reconversion Tempo in 1946

NEW YORK.—Indicating that the sale of gas for industrial and commercial purposes will closely follow the tempo of over-all general business reconversion in 1946, H. Carl Wolf, managing director of the American Gas Association states:

"The domestic gas load has continued to flow, and every indication is that this growth will be accelerated when new appliances, with new features resulting from the intense research program of the industry, start coming off the assembly lines. The rapidity with which gas can be applied to industrial processes creates no problem. . . . The new research program of the gas industry is opening up new uses for both domestic and industrial gas as well as improved methods of manufacturing.

"The sum total of these developments and tendencies would indicate enlarged uses of gas during the coming year. The effect of this expansion on net earnings will depend in large degree on the ability of the Government to hold in line prices for materials used by the gas companies, since the selling price of the commodity is at practically ceiling."

1945 Market Production

Total market production of natural gas in 1945 was 3,689,200,000 M.c.f. For the 12-month period ending November 30, 1945, sales were approximately 25,322,247,600 therms, representing an increase of 2.1 per cent over a year ago. Figures as of December 30 are not yet available.

In a report of utility gas sales for the third quarter of 1945, the American Gas Association points out that revenues of the gas utility industry totaled approximately 218.7 million dollars, representing an increase of 0.9 per cent over revenues of 216.8 million dollars in the same quarter of 1944. Revenues from residential sales were 129.3 million dollars, an increase of 4.9 per cent over 1944, the report states. Industrial revenues, however, decreased 8 per cent, falling from 70.6 million dollars in 1944 to 64.9 million in the current year.

Commenting on the revenues from sales of manufactured and mixed gas, the report states that the total of 97.5 million dollars earned in the quarter ending September 30, 1945, showed a gain of 3.2 per cent over revenues in the same quarter of 1944. Total sales in M.c.f. in the quarter were up only 0.9 per cent from approximately 96.1 million last year to 96.9 million M.c.f. in the current year.

The number of customers purchasing manufactured and mixed gas increased 1.3 per cent to more than 10.7 million as of the end of 1945's third quarter. Residential customers were up 1.1 per cent. Identical gains of 5.4 per cent were made in the commercial and industrial classes. The number of residential central heating customers was 7 per cent greater in 1945.

In the 12 months ending September 30, 1945, revenues from all classes of manufactured and mixed gas sales were 453 million dollars, or 4.2 per cent higher than revenues for the same period ending in 1944. Commercial revenues gained 11.5 per cent, and revenues from residential sales increased by 3.8 per cent but industrial revenues decreased slightly from 49.6 per cent to approximately 49.3 million dollars, or a loss of 0.7 per cent.

Natural gas revenues in the third calendar quarter of 1945 decreased 0.9 per cent, falling from 122.2 million dollars last year to 121.2 million in the current year.

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Among the Drilling Contractors

Demas & Waterbury is the name of a new firm of drilling contractors at Mount Carmel, Ill. The firm is composed of Nick Demas and Paul Waterbury, both of whom are experienced oil men. They will operate a modern rotary rig in midwest oil fields.

Newell & Chandler, of Calgary, Alta., have a contract for three tests to be drilled for British American Oil & Development Corp. on acreage in the Cat Creek field of Montana held jointly with the Central Montana Oil Co.

Leonard Drilling Co. is the contractor on Rowmor Corp. 1 Richard O. & Erich C. Borek, NW SE NW 3-11n-2e in Saginaw County, Michigan.

C. E. (Dock) O'Neal, Evansville, Ind., is rotary drilling contractor on a test for C. P. Chandler. It is the 1 J. R. Lin, in 32-1s-8e, Wayne County, Illinois. This is the first test O'Neal, an independent operator, will make after recently resigning from Deep Rock Oil Co. It is about ½ mile northeast of Fairfield.

Cox Drilling Co. is the contractor on the Chester Oil Co. 1 Evert Hunt, in SE NE 14-1s-10w, Gibson County, Indiana. The test will go to 1,750 ft.

Williams & Boling will drill for Arthur E. Williams the 1 Long, NW SE SE 15-9n-1w, in Gratiot County, Michigan.

Portable Drilling Co., Tulsa, is contractor on the R. U. Porter (K. G. F. F. Oil Co.) 1 King Community, in SE SW SW 2-11n-6e, Pottawatomie County, Oklahoma, 1½ miles southeast of the Prague pool. The well was drilling below 1,185 ft.

W. R. McMaster, formerly of Caledonia, Ont., has signed a contract with Gaspe Oil Ventures, Ltd. of Montreal for Venture No. 1 well to be drilled on the Gaspe Peninsula of Quebec. McMaster has handled contracts not only in Ontario and Alberta but in Texas, Oklahoma, Wyoming, Montana, Ohio, and Pennsylvania, as well as the Tampico field. His Gaspe contract includes building and maintenance of 3 miles of road, clearing of the drill site, erection of camp buildings and derrick, transportation and installation of equipment, and drilling to 3,000 ft. maximum depth, with a time schedule that calls for testing to begin July 13, 1946.

Stickle Drilling Co., Tulsa, has been organized with Frank E. Stickle, former secretary-treasurer of Mabee Oil & Gas Co., as president and general manager, and Robert B. Parriott, petroleum engineer recently separated from the Army in the grade of lieutenant colonel, as vice president.

Kerr-McGee Oil Industries, Inc., has purchased $424,270 of stock of the **N. B. K. Drilling Co.** from the estate of the late Harry J. Brown, one of the founders of the company. Kerr-McGee attorneys said the other stockholders, M. T. Meyers, Mack Borning, and Miss Elaine Barnes, also have agreed to sell their stock.

Trio Drilling Co. has been contracted by Arthur E. Williams to drill four wells in Gratiot County, Michigan. The wells are 1 Juanita Watson, NW SW SW 14-9n-1w; 1 Castler, SE SE NE 15-9n-1w; 2 Joel Kral, NW NE SE 15-9n-1w, and 1 Casper Kerr, NW SE SE 9-9n-1w.

B & B Drilling Co. has the contract and was moving tools to start on a Bromide sand test in the Pauls Valley, Okla., townsite, Garvin County. Pecos Valley Alfalfa Milling Co. is operator of the venture, which is located in NE NE SE 7-3n-1e, near the northwest edge of the town. Nearest producer is 1¼ miles south, and is a Pennsylvanian sand well.

Martin Harris will drill J. H. Gwin 1 Rice, SW SW SW 14-11n-7w, in the Cary field of Sharkey County, Mississippi.

C. W. Ramsey will drill a wildcat in Kent County, Michigan, for Jones Development Co. The well is 1 A. J. WeDilde, SW SW SW 28-9n-11w.

Olsen-Blount Drilling Corp., Oklahoma City, was drilling in anhydrite at 1,200 ft. on the 1 R. Olsen-Steeler, in C SW SW 20-23s-37e, Lea County, New Mexico. On the R. Olsen 1 Boyd, in the C SW SW NE 23-22s-37e, same county, drilling in deep lime at 4,710 ft. On the Olsen-Blount and Western Gas Co. 1 Eaton, in C SW SW 12-25s-37e, which was spudded Novem-

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BAKERSFIELD, VENTURA AND AVENAL, CALIFORNIA

ber 24, testing was proceeding at total depth of 4,913 ft., after treatment with 500 gal. acid first treatment, and 1,500 gal. second treatment.

Phinney Brothers has the contract to drill James J McGerry, Trustee, 1 Howard B. Williams, NE NE SW 36-9n-11w, in Kent County, Michigan.

Robert W. Atha was awarded the contract by Gulf Refining Co to drill 2 Walraven, NE SE SW 16-14n-6e, in Bay County, Michigan.

Virginia Drilling Co., Inc., was moving in tools to start on the R. H. Shields 1 Sheppard, in W½ SW SE 16-22-11w, Stafford County, Kansas. Location is 2 miles east and ½ mile north of the Richardson pool.

Safety, Congestion, Taxes Termed Highway Problems

OKLAHOMA CITY.—Continued expansion of the nation's automotive transportation depends on the solution of such problems as highway safety, traffic congestion and taxes, L. S. Wescoat, chairman of the American Petroleum Institute committee on highways, told the American Association of Highway Officials at its annual meeting here.

"The oil industry is proud of its contribution to the development of highway transportation," Wescoat said, "just as I know you men are deservedly proud of the remarkable highway building achievements . . . Nothing like it ever happened before in history."

The continuous gains forecast in highway transportation during the next 15 years are based on several assumptions, he said. "Highway safety must be provided, traffic congestion, and parking problems are vital issues which must be satisfactorily met. Taxes must be reasonable and sound. Operating costs for vehicle owners must not get out of line."

He condemned diversion of gasoline tax funds, declaring that their dissipation through unwarranted or improper expenditures is another "formidable barrier to orderly progress in the development of highway transportation. He suggested that exemptions from payment of gasoline taxes be re-examined in the light of inequities and abuses.

Wescoat, vice president of the Pure Oil Co., said the importance of automotive transportation was brought home to the American people during the war. He said a 10-state survey showed 86 per cent of all industrial workers were dependent on motor vehicle transportation. Other surveys show that 54,000 communities, nearly half of the nation's total, are wholly dependent on highway vehicles. Fifty large cities, he added, receive all their milk by truck, and two-thirds of the total tonnage of livestock moves by truck.

ON WORK-OVERS and for DRILLING-IN Use BJ COMBINATION HOOKS

★ Hook has a soft spring with a full 5 inch travel.

★ It is made both with and without swivel locks as required.

★ Designed for direct connection to popular make traveling blocks.

★ Capacities from fifty to seventy-five tons.

★ Safety factor: 4 to 1.

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"Best Bet Yet"

These oil-proof, wear-resistant, plastic tubing protectors are an integral part of the tubing collar. Made in all sizes, they prevent the metal-to-metal contact that has caused many expensive "wet" jobs in pumping wells in the past.

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PERSONALS

Dalton Is Appointed Socony-Vacuum's Chief Engineer

SOCONY-VACUUM OIL CO.'s new chief engineer of the refinery division, manufacturing department, is a native Californian. Swanton D. Dalton is the name. Santa Cruz is his birthplace.

Dalton has been wth the Socony-Vacuum organization since joining General Petroleum Corp., a subsidiary, in March 1933, when he worked in the Torrance refinery laboratories. In 1938 he became assistant supervisor of General's laboratories and in 1940 was named process engineer of Socony-Vacuum's refinery engineer division. In 1943 he became assistant chief engineer of the refinery engineering division in charge of processing and operating.

Dalton succeeds George S. Dunham, who will represent midwestern refineries and engineering on the manufacturing committee.

A 1931 graduate of Stanford University, with a B.S. degree in chemistry, Dalton later took an M.S. in chemical engineering at Massachusetts Institute of Technology.

Edward D. Lynton will leave soon for Paris to become consultant in oil development and production to the French Government. He will be on 2 years' leave of absence from California Research Corp., a subsidiary of Standard Oil Co. of California.

Will I. Lewis, independent producer and drilling contractor, has been named president of the Illinois Oil and Gas Association. **Basil Moss,** member of the land department of Magnolia Petroleum Co., has been elected treasurer.

L. G. Mason, former development manager of mechanical rubber goods for Seiberling Rubber Co., has been appointed manager of Phillips Petroleum Co.'s new Philblack sales service laboratory in Akron.

Frank M. Schell, 65, general superintendent of production, northern division, South Penn Oil Co., has retired after 48 years of service.

C. C. A. Beels, manager of the land division of the exploration department of Carter Oil Co., has been transferred to Standard - Vacuum Oil Co. to become its representative in The Hague, Holland. He will leave Tulsa February 15 for an initial assignment in Standard-Vacuum's New York office. In the Carter organization he will be succeeded by **N. Y. Ruth,** who has been manager of the exploration department of the northern division.

C. C. A. BEELS

H. W. Loveland, president of the Bradford National Bank, Bradford, Pa., and **J. H. Young,** vice president of South Penn Natural Gas Co., have been elected directors of the South Penn Oil Co. to fill vacancies caused by the death of Samuel W. Gregg, Sr., and the retirement of **J. G. Ward.**

P. T. Lamont, resident advisor in Europe and foreign market coordinator for Standard Oil Co. (New Jersey), is scheduled to leave this country soon, probably for Switzerland. **Otto Lessing,** Jersey Standard assistant head of foreign marketing engineering, is also slated for a trip to Europe, Egypt, and North Africa.

Harrison L. Hays, assistant superintendent of the Plains butadiene plant in the natural gasoline and gas department of Phillips Petroleum Co., has been transferred to the main office at Bartlesville.

Alex J. Diepenbrock, production and petroleum engineer, has joined the geological firm of **Luis E. Kemnitzer** and **L. W. Richards** in Los Angeles. A former manager of production for Petrol Corp., he was assistant director of production in Los Angeles for the Office of Petroleum Coordinator and later served overseas in the Navy.

Ralph R. Demsey, who recently returned to Standard Oil Co. of New Jersey, after separation from the Army in the grade of lieutenant colonel, has been appointed technical assistant in the oil movement and storage department of the Bayway refinery succeeding **Wallington J. Ricketts** who was transferred to the manager's office.

Victor E. Baum, former superintendent of production of Boeing Airplane Co., has resumed his prewar office of president and general manager of Bace Oil Co., Inc., with headquarters in Wichita.

W. R. Casserly has resigned as superintendent of construction and maintenance of Sinclair Refining Co.'s pipe-line department to become assistant to the president and general superintendent of operations of W. J. Small Co., Inc.

Phillip S. Magruder, who joined General Petroleum Corp. in 1925 as a gas tester, has been made vice president. Magruder in 1942 was made manager of the gas department and last autumn was appointed head of the manufacturing department and elected to the board of directors. He was one of the operators of the California Natural Gasoline Association.

C. T. FOSTER

Clyde T. Foster, assistant to the president of Standard Oil Co. (Ohio), has been elected a vice president. Foster joined Ohio Standard in 1929, became assistant to the president in 1942 and last August assumed the duties of vice president and treasurer during the absence of **William J. Semple** on account of illness.

Eugene Fisher, petroleum engineer in the production department of Stanolind Oil & Gas Co., has been elected president of the new Permian Basin chapter of the American Institute of Mining and Metallurgical Engineers

which was recently organized as the successor to the Permian Basin Engineers Association. Other new officers are **Lee Flood,** chairman of the Goldsmith Pool Engineering Committee, vice president, and **S. V. McCollum,** division petroleum engineer for Continental Oil Co., secretary-treasurer.

James M. Phillips, former engineer for Stanolind Oil & Gas Co., has joined Southern Natural Gas Co. in Birmingham following his discharge from the Navy.

L. V. Stanford, president of Sinclair Cuba Oil Co. and president of Tri-Pet Corp., has left the United States for an extended business trip to Cuba, Colombia and Venezuela.

C. E. FINNEY, JR.

C. E. Finney, Jr., who joined Standard Oil Co. of California in 1919 at its Richmond, Calif., refinery has been elected a vice president in charge of industrial relations. Finney became general manager of California Standard's manufacturing department 3 years ago. The other new appointments in the manufacturing department are **G. H. Langsdorf** as manager, technical services, and **O. N. Miller,** formerly superintendent of the El Segundo refinery cracking division, as assistant to the vice president in charge of manufacturing.

Edward L. Steiniger, vice president of Sinclair Oil Co., Caracas, Venezuela, is now visiting this country on a combined business and pleasure trip. He plans to return about the end of January.

John H. Wilson, Independent Exploration Co., has been elected president of the Fort Worth Geological Society. **E. M. Rowser,** The Texas Co., is vice president, and **S. K. Van Steenburgh,** Sinclair Prairie Oil Co., secretary-treasurer.

Henry P. Evans, Skelly Oil Co., has been chosen president of the Kansas Oil Scouts Association. Other new officers are **Darwin O. Spore,** Cities Service Co., first vice president; **Lynn C. Williamson,** Magnolia Petroleum Co., second vice president; **Dewitt L. Chapman,** British American Oil Producing Co., secretary-treasurer.

Dr. J. C. Sproule, subsurface geologist for Imperial Oil, Ltd., in Alberta, will leave Calgary shortly for Toronto to become assistant to the chief geologist of International Petroleum Co., Ltd. **Dr. E. W. Shaw,** who has been in Imperial's exploration department, will succeed Dr. Sproule.

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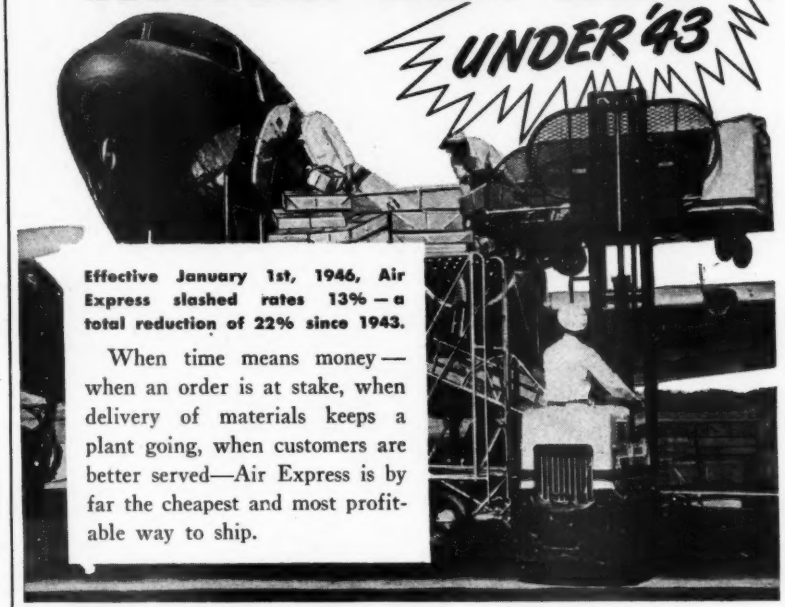

Effective January 1st, 1946, Air Express slashed rates 13% — a total reduction of 22% since 1943.

When time means money — when an order is at stake, when delivery of materials keeps a plant going, when customers are better served—Air Express is by far the cheapest and most profitable way to ship.

Specify Air Express-a Good Business Buy

Shipments travel at a speed of three miles a minute between principal U. S. towns and cities, with cost including special pick-up and delivery. Same-day delivery between many airport towns and cities. Rapid air-rail service to and from 23,000 off-airline points in the United States. Service direct by air to and from scores of foreign countries in planes made in America, operated by American personnel and flying the U. S. flag.

HERE'S HOW LITTLE IT COSTS (U. S. A.)					
AIR MILES	2 lbs.	5 lbs.	25 lbs.	40 lbs.	Over 40 lbs. Cents per lb.
149	$1.00	$1.00	$1.00	$1.23	3.07
349	1.02	1.18	2.30	3.68	9.21
549	1.07	1.43	3.84	6.14	15.35
1049	1.17	1.98	7.68	12.28	30.70
2349	1.45	3.53	17.65	28.24	70.61
Over 2350	1.47	3.68	18.42	29.47	73.68

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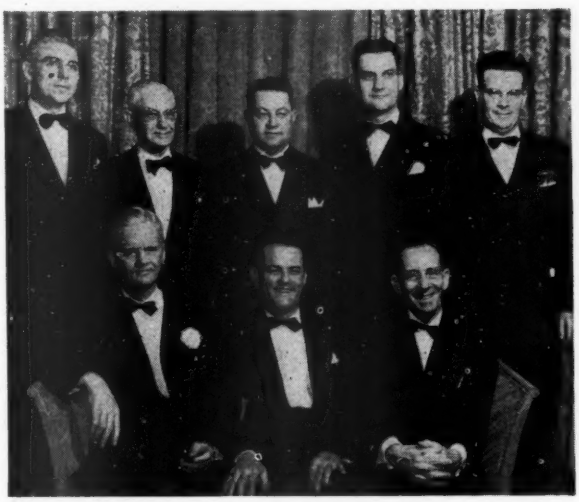
Equipment Men in the News

Houston Nomads Install New Officers at Annual Dinner Dance



At the annual dinner dance held in the Crystal ballroom of the Rice Hotel, January 8, the Houston Chapter of Nomads installed officers for 1946. As shown in the photograph the officers are, seated: Charles W. Thornhill, Thornhill-Craver Co., president; Charles E. Richards, Gray Tool Co., vice president; George E. Tyson, Jones & Laughlin Steel Corp., secretary-treasurer. Standing: Tom W. Nelson, Gulf Publishing Co., regent and retiring president; C. E. Whitney, Baker Oil Tools, Inc., regent; C. B. McDonald, A-1 Bit & Tool Co., deputy sergeant - at - arms; Herschel J. Wood, Lebanon Steel Foundry, sergeant-at-arms; Harry E. Estes, Reed Roller Bit Co., executive secretary. Not shown in picture is Jay L. Speece, Gardner-Denver Co., assistant secretary-treasurer.

E. L. Decker Becomes Sole Owner Of Martin-Decker Corp.

At a luncheon recently tendered members of the trade press at the Virginia Country Club, Long Beach, Calif., announcement was made that W. R. (Frosty) Martin had disposed of his interest in Martin-Decker Corp. By this move Martin retires from active participation in the company, and E. L. Decker becomes president and sole owner. There will be no change in company name, nor in policies.

The formation of Martin-Decker Corp. 17 years ago brought together two remarkable personalities. "Frosty," scion of a famous pioneer oil family, has been connected with the oil industry 67 years starting as a boy of 8 tending his father's three stripper wells in Pennsylvania. He is reputed to be the oldest oil man in California in point of service. In recent years he has acquired newspaper interests and gives much of his time and energy to harbor development. This activity has led to numerous high positions of trust among port authorities of the nation.

Besides his efforts in developing drilling-control instruments to lower drilling costs, Elmer Decker is widely known for his broad interest in the welfare of the oil industry and civic affairs. He was one of the founders and first president of the Nomads. He helped organize and is president of Equestrian Trails, Inc., a California state-wide organization of horsemen, and is a chairman of a committee to further the state bridle-trails program. "Deck" is vice president and director of the Long Beach Chamber of Commerce and active in many civic activities.

E. L. DECKER and W. R. MARTIN

The Briggs Filtration Co. Acquires Briggs Clarifier Co.

The engineering and manufacturing enterprise founded in 1933 by Chase Donaldson and S. W. Briggs as Briggs Clarifier Co. took its final peacetime form on December 1, when the business was acquired by The Briggs Filtration Co., a Maryland corporation. The officers of the new company, all of whom served with the old company, are Chase Donaldson, president; S. W. Briggs, vice president; R. C. Zschiegner, treasurer; W. E. Furey, secretary-counsel; Cecil Hopkins, assistant secretary.

Rockwell Machine Co. New Name Of H. A. Smith Machine Co.

The H. A. Smith Machine Co., Hopewell, N. J., has been renamed Rockwell Machine Co. Rockwell Machine Co. is a subsidiary of Rockwell Manufacturing Co. and supplies precision machined parts to other subsidiaries and divisions of the latter concern. The change in name is accompanied with no personnel or policy changes. Herbert S. Rockwell continues as director of operations at the Hopewell plant.

W. C. Norris Manufacturer, Inc. Elects Eustice President

J. H. EUSTICE

At a special board of directors meeting of W. C. Norris Manufacturer, Inc., J. H. Eustice was elected president to succeed the late Don S. Bowers. Eustice has literally grown up with the company he now heads. He started to work for Norris 35 years ago, when he was just 11 years old, just a few months after the plant was moved to Tulsa from Tiona, Pa. His father was one of the men whom Norris brought with him in the move.

He worked at miscellaneous odd jobs until he finished school, when he became a full-time employe and was put in charge of the warehouse and shipping departments. A year later he was transferred to the office by Don Bowers as bookkeeper, and in 1925 he was relieved of the bookkeeping job and started sales work. In 1938 he rose to the position of sales manager. In 1943 he became general manager, and in 1945 with the death of Norris and the election of Don Bowers to president of the company, Eustice was made executive vice president.

Le Roi Co. Names John M. Dolan Vice President in Charge of Sales

Le Roi Co., Milwaukee, manufacturers of engines, air compressors, generator sets, and specialized highway - airport - railway mowers, announces the appointment of John M. Dolan as vice president in charge of sales. Dolan joined Le Roi in October 1943, and since his association with this company, has been active in establishing over-all merchandising programs covering all phases of the product line in both domestic and foreign fields.

Cecil W. Brown is named as general sales manager, succeeding to the position formerly held by Dolan. Brown has been with the company since 1938, and has held numerous positions including those of chief draftsman of the air compressor department, coordinator of government contracts, assistant purchasing agent, superintendent of the assembly and test department, field engineer, and assistant sales manager.

Arthur A. Ladwig has been named as vice president in charge of manufacturing. He has been with Le Roi since May 1923. He started in the shop and successively worked as timekeeper, cost clerk, and engineering specification clerk. He was promoted to production manager in 1936, general superintendent in 1938, and works manager in 1942.

JOHN M. DOLAN and CECIL W. BROWN

Mel Morsbach, district representative for Caterpillar Tractor Co., and Ed Butler, a partner in the Southwest Machinery Co., distributor in Oklahoma City environs, snapped during a visit to Caterpillar sales headquarters at Peoria, Ill.

General American Transportation Corp. Announces Changes

General American Transportation Corp. has announced the following changes among its officers, additional to the retirement of LeRoy Kramer, first vice president. W. J. Woodward retires from his position as director and treasurer after 33 years with General American. Edward E. Schulz, 26 years with the company is appointed treasurer and assistant secretary. H. E. Coyl and W. J. Stebler, vice presidents, are elected to the board of directors.

Worthington Transfers Barnaby

James C. Barnaby, consulting engineer of Worthington Pump & Machinery Corp., has been transferred to the general engineering staff at the Harrison Works as assistant director of research and development.

Virgil Stover Heads New Division Of Buda Engine Sales & Service

Buda Engine Sales & Service, Inc., Tulsa, announces the appointment of Virgil Stover as manager of the newly created industrial sales division. His work will cover the company's entire territory comprising Oklahoma, Kansas, Nebraska, Wyoming, Montana, Southern Illinois, and Indiana. For the past year Stover has been the company's sales engineer, working in Tulsa, where he will continue to reside.

Sears and Penick Promoted By Link-Belt Co.

Link-Belt Co. announces that Joseph W. Sears, heretofore district sales engineer at the Link-Belt plant in Dallas, has been appointed district sales manager with headquarters at 711 Main St., Houston. Also announced is the appointment of Stuart Penick as district sales engineer at Dallas, to fill the vacancy created by Sears' transfer to Houston.

Two Division Heads of Du Pont Explosives Department Retire

The retirement January 1 of the heads of two divisions of the Du Pont explosives department is announced. They are C. A. Woodbury, manager of the technical division, and I. J. Cox, manager of the American glycerin section and production manager of the black powder section. Woodbury will be succeeded by Dr. B. H. Mackey. The duties of Cox in the American glycerin section will be taken over by G. H. Loving, an assistant director of sales of the explosives department, and those in the black powder section will be taken over by H. K. Babbitt, production manager of the special products section.

Villa Announces Firm's Appointment to Represent U. S. Concerns

Mario L. Villa, president of Technica Industrial y Comercial Petrolera, S.A., Buenos Aires, announces that his firm has been appointed exclusive representatives for Byron Jackson Co., Patterson-Ballagh Corp. and International Cementers, Inc., for Argentina. In addition this firm is exclusive representative in that country for Continental Supply Co., and handles Lummus for Argentina, Bolivia, Chile, Paraguay, and Uruguay.

Oscar D. Nelson Becomes President of Butler Mfg. Co.

The office boy of 1910 became the president and general manager of Butler Manufacturing Co. when Oscar D. Nelson stepped into the presidency succeeding E. E. Norquist, one of the founders of the business in 1901, who was elected chairman of the board.

Both men have seen the company expand from a sizable concern manufacturing steel stock tanks to one of the largest steel products companies of its kind, with factories at Kansas City, Galesburg, and Minneapolis. Its other four divisions manufacture oil equipment, steel buildings, cleaners' equipment, and special products.

Norquist, who had shaped steel tanks by hand, was first plant manager, then vice president, and president after 1927. Nelson was made assistant treasurer in 1917 and treasurer in 1923. He was elected to the office of general manager and treasurer in 1929.

F. A. Rufi, who came with the company in 1909 and has been secretary since 1927, has been elected treasurer. Glen C. Speakman, who has been with the company since 1923 and general sales manager since 1936, was elected a vice president. C. C. Crouch, in charge of advertising and sales promotion, was reelected vice president. Roy S. Kemp, credit manager, was reelected vice president, as was John Nelson, who also was named a special representative of the company.

Darius Melcher, who joined the company in 1928, was named manager of the Minneapolis division. In 1939 he became assistant treasurer and manager of the Galesburg division and was elected to the board in 1945.

Sexton Resigns Norris Post; Joins Bradford Motor Works

Ray M. Sexton has resigned as sales manager of W. C. Norris Manufacturer, Inc., to accept the same position with Bradford Motor Works, Inc., of Bradford. Bradford Motor Works manufactures a line of oil-well pumps and other production specialties and maintains complete factory stocks at the Mid-Continent branch at Tulsa.

Sexton will continue to reside in Tulsa and make his headquarters at the company's Tulsa branch.

Geary Resigns Sales Post With Rustless Steel

Edward P. Geary, who has been assistant vice president in charge of sales of Rustless Iron & Steel Corp., Baltimore, for the last 6½ years, has resigned. He has not yet announced his future plans.

Chicago Bridge & Iron Co. Reopens Detroit Office

Chicago Bridge & Iron Co. has reopened its sales office in Detroit, Mich. It is located in the Lafayette Building. Edward D. Barrett, formerly of the Chicago office, is in charge.

New officers of the Tulsa Chapter of Nomads were installed January 23 at the annual reception and dinner of the group held at the Tulsa Club. Guest speaker at the affair was Arrigo Righi, of Pan American World Airways, who addressed the members and guests on "International World Airway Policies." Officers in the picture above are: Shep Miers, manager, Southwest Supply Co., regent; Gene Elder, Mid-Continent manager, Pittsburgh Steel Co., deputy sergeant-at-arms; Mitchell Tucker, manager of market research, The Oil and Gas Journal and Petroleo Interamericano, secretary; M. D. Gilbert, district sales manager, Pittsburgh Equitable Meter Co., treasurer; Henry Bourne, district sales manager, Republic Steel Corp., president; W. G. Green, president, Engineering Laboratories, Inc., regent; Earle E. Smith, district sales manager, National Tube Co., assistant secretary; and J. H. Eustice, president, W. C. Norris Manufacturers, Inc., sergeant-at-arms. Not present in the picture are Russell Hunt, attorney, vice president, and K. O. Noevel, district sales manager, National Supply Co., assistant treasurer